SCIENCE

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THE FOREST RESERVATION POLICY.

ON March 3, 1891, the Congress of the United States enacted into law a new and important policy, namely, that the government should own and hold in perpetuity certain lands other than those needed for its immediate purposes or those set aside for parks.

This departure from the accepted policy of the past, according to which the public domain is held by the government only until it can be disposed of to actual settlers, was based upon the perception that a forest cover on slopes and mountains must be maintained to regulate the flow of streams, to prevent erosion and thereby to maintain favorable conditions in the plains below.

Enormous devastation of the public timber by theft and fire has gone on for decades, through absence of any care and through lack of any rational system in the manner of permitting the utilization of the wood material by the resident population. For the last 25 years every Secretary of the Interior, every Commissioner of the General Land Office, has pointed out this deplorable condition and has asked for legisla-

tive relief. Bill after bill has been introduced for the protection of the public timber, but most of these never found consideration even in the committees, much less on the floor of the two Houses of Congress.

HISTORY OF FOREST RESERVATIONS.

In 1887 the then Secretary of the American Forestry Association formulated and had introduced into the 50th Congress an elaborate bill (afterwards in modified form known as the 'Paddock Bill,' 52d Cong., Senate 3,235) providing for the withdrawal of all timber lands on the public domain from entry or other disposal, setting the same aside as public forest reservations, and instituting a fully organized service in the Department of the Interior to take care of such forest reserves, protecting them against fire and theft, regulating their occupancy by prospectors, miners and herders, and permitting the cutting and sale of the timber under a system of licenses and under application of rational forestry methods.

Of this radical yet reasonable legislation all that could be obtained was the enactment of a brief clause, inserted at the last hour of the 51st Congress into 'An Act to repeal Timber-culture laws and for other purposes.' The credit for securing this recognition belongs to the then Secretary of the Interior, Hon. John W. Noble. This clause, approved March, 1891 (Public—No. 162, Sec. 24), by which the important policy of forest reservations was established, reads as follows:

> That the President of the United States may from time to time set apart and reserve in any State or Territory having public land bearing forests, in any part of the public lands, wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations, and the President shall, by public proclamation, declare the establishment of such reservations and the limits thereof.

Under this law seventeen forest reservations were made, sixteen by President Harrison, largely at the end of his administration, and one by President Cleveland, on September 28, 1893. The estimated area of these is 17,500,000 acres. In some cases these were asked by petition and were investigated by the General Land Office; in others they were announced without previous public notice. In the absence of specific legislation the Secretaries of the Interior construed the reservation of these lands as a withdrawal not only from sale and entry, but from all use whatsoever, the Department being powerless to protect or utilize the same. *This was never the intention of the projectors of the forest reservations.*

As a result, strong opposition has grown up in the States where these large areas had been withdrawn from use. Although petitions for a number of other reservations had been prepared, the advocates of the reservation policy have not considered it wise to extend the reservations until the needed legislation could be had providing for their rational use and administration.

When it became apparent that the original bill (the Paddock bill), although most desirable was too elaborate to be considered by Congress, a short bill, leaving the detail of framing rules of occupancy and use to the Secretary of the Interior, was prepared. This has become known as the McRae Bill (53d and 54th Congress, H. R. 119), Hon. Thos. C. McRae, Chairman of the Committee on Public Lands of the 53d Congress, having with great interest forwarded the same. This bill, with amendments, was passed by the House of Representatives in December, 1895, and almost the same bill, with further amendments was passed by the Senate, but failed to become law. During the second session of the 54th Congress the McRae Bill (H. R. 119), again modified, was again passed by the House, but remained unreported from the Committee on Forest Reservation in the Senate, while a bill, essentially the

same, was reported from that committee but remained on the calender without action.

In the fall of 1895, finding that the arguments for legislation did not procure its enactment, the Secretary of the Interior was induced by the Executive Committee of the Forestry Assaciation to call upon the National Academy of Science for an expression of advice as to the need and methods of a proper administration of the public timber lands, in order to secure the weight of authority of that body to the proposition. The Academy, as customary, appointed a committee, asked an appropriation of $25,000 for the purpose of field examination, and members of this committee visited the regions where public timber lands are situated. As a result of this journey a report was made to Hon. D. R. Francis, Secretary of the Interior, advising the reservation of some 20,000,000 acres. On February 22d President Cleveland, following the suggestion of Mr. Francis, proclaimed the reservations asked for.

This sudden withdrawal from use of such a vast area, some of which was occupied by mining and lumbering industries dependent upon wood supplies, created strenuous opposition in the Senate and led to the adoption of a clause in the Sundry Civil Appropriation Bill at once restoring these reservations to the public domain. The House members of the Conference Committee, however, succeeded in substituting an amendment by which practically the main provisions of the McRae Bill were incorporated, namely, empowering the Secretary of the Interior to regulate their use and occupancy by miners, herders, etc., and for the sale of timber as needed under proper forestry regulations. This amendment failed of acceptance, except that part which empowers the President to restore all or parts of the reservations. The bill did not become a law, not being signed by the President.

REASONS FOR THE ESTABLISHMENT OF FOREST RESERVATIONS.

The forest and brush cover of the mountains in the country west of the 100th meridian occupies a small proportion of the total area, probably not more than 35 per cent. The timber of useful kinds occupies hardly 15 per cent. of the whole. The distribution and character of this growth is extremely variable, from the chapparal and stunted growth of southern California and the open pine, cedar and spruce of the lower Rocky Mountains to the magnificent world-famed giants of the Sierras and the dense unmatched forest growth of the Cascade and Coast Ranges in northern California, Oregon and Washington. Corresponding to the difference in distribution and development of forest growth, the climate, especially with reference to moisture conditions, varies. The northwestern portion of the Pacific coast has an abundance of rainfull and high relative humidity; the southern portions and lower Rocky Mountains are more or less arid. In either section a forest cover of the higher elevations and slopes is needful; in the one case to hold back the snow and rain waters from inundating agricultural lands below; in the other case to preserve the scanty water supply by impeding evaporation. In both cases the wood supply needs careful husbanding, for, in the absence of something better, even the poor material of the southern areas is needed for domestic uses. The magnificent timber of the Northwest, most wastefully lumbered and shipped away while the home consumption is limited, will ere long be needed at home and should be cut with due regard to the future and to reproduction.

The attempts of the goverment to protect its own property have been ineffectual and futile. The laws enacted in 1878 appear to make legal a systematic plundering of this property. Hundreds of square miles have been absolutely destroyed by un-

checked forest fires. Thousands of acres of valuable timber have been appropriated without any equivalent to the Treasury and without even an attempt at settlement as contemplated under the law. There are no provisions now on the statutes under which any citizen can obtain wood from the public domain by purchase, except that on the Pacific coast a man may buy 160 acres of it at $2.50 per acre for his own personl use only. A mining company needing timber must either steal, buy stolen timber, or obtain it by circumvention or perversion of the law—at least of its intention, if not its wording. Large mill establishments, able and willing to pay, are forced to cut logs on government land free of charge under a permit system, which was invented for the single settler, the pioneer, whose right to help himself to what he needed was thereby established. Hundreds and thousands of men have been induced to perjure themselves, in order that a lumbering company might acquire sufficient acreage from which to supply itself with timber.

Not only has this baneful legislation led to the destruction of millions of dollars worth of forest growth, but it has prevented any reasonable administration of the public timber domain, and has tended to lower the moral plane of otherwise estimable citizens with regard to their respect of public property.

"The community has become demoralized with reference to this question, for it is forced to steal one of the necessaries of life. The paramount and absolute necessity to obtain timber for use overrides all considerations. To the miner and settler the use of timber from local supplies is as absolutely necessary as the use of water and air, and no plan of management which fails to recognize this necessity can hope to be successful."

The proposed forest laws are designed to remedy this condition of antagonism between the population and the administration, which is vainly trying to enforce unreasonable laws. Reservation is the first step; regulation of the use of the timber the second; perpetuation of a valuable resource for coming generations the object.

The program of those urging this policy is as follows:

1. Withdraw from sale or entry all lands not fit or needed for agriculture, and constitute as objects of special care by the government the lands at the headwaters of streams and on mountain slopes in general.

2. Permit prospecting, mining and other occupation under such regulations as to prevent unnecessary waste, and cut and sell the timber under such methods as to secure perpetuation and renewal of the forest growth.

3. Provide for protection against fire, theft and unlawful occupancy.

4. Respect all existing vested rights, and arrange an exchange, if necessary, for private lands included in reservations; finally, restore to the public domain for entry all lands which are found within the reservations fit for agriculture.

5. The rational management of these forest areas for the benefit of the future as well as of the present and for all interested without destruction.

These are the business-like propositions embodied in the so-called Paddock Bill, and the same underlie the less elaborate McRae Bill, passed by the House of Representatives in the first session of last Congress, and also underlie the clause which the House tried to incorporate in the Sundry Civil Bill of the second session of the 54th Congress. The interests of the miner, the lumberman, the settler, of every citizen in the present and in the future, is to be taken care of in these forest reservations.

There is one industry, and one only, that finds no consideration in this policy. It is that of the sheep herder. Not that his

business is considered illegitimate as such, but, carried on as it has been, it is incompatible with all the other interests which the forest may subserve. Roaming through the woods, from township to township, from county to county, from State to State, the herds not only destroy the herbage and young trees and seedlings, but the irresponsible herder burns over the pasture, kills the underbrush and young growth that may have sprung up. This treatment, added to the trampling of the soil by the sharp hoofs of the sheep, finally changes the surface so that no seed can germinate, and natural reproduction is prevented and the forest is doomed to destruction. Just as the proverbial incompatibility of the goat and the garden, so the growing of wool and wood on the same gound is incompatible.

Some of the provisions of the bills as passed by the House do not meet the approval of the Executive Committee of the American Forestry Association; nevertheless the main principle underlying, namely, the recognition of the legal status of the forest-reservation policy and of the necessity of their rational management, make it desirable to have this legislation enacted, with the expectation of amending its faulty provisions later.

It is hoped that the 55th Congress will fully recognize the wisdom of upholding the forest reservation policy, and will enact the legislation necessary to make the reservations useful to the fullest extent.

B. F. FERNOW,
Chairman Executive Committee,
American Forestry Association.

EXPERIMENTS UPON METABOLISM IN THE HUMAN BODY, UNDER THE DIRECTION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.

THE Department of Agriculture has received and is about to publish the details of the experiments on the nutrition of man, the brief reports of which have lately excited so much interest in different parts of the country. These experiments are carried out under the auspices of the Department of Agriculture, at Wesleyan University, in Connecticut, in cooperation with the Storrs' Experiment Station. They belong to a series of inquiries upon the economy of food and nutrition which are being prosecuted in cooperation with universities, college settlements and benevolent associations in different parts of the country. The special objects and methods of the experiments in Connecticut are referred to by Professor Atwater, special agent of the department in charge of nutrition investigations, as follows:

"Research upon nutrition has brought us to the point where the study of the application of the laws of the conservation of matter and of energy in the living organism are essential. For this purpose a respiration calorimeter is being devised. This is an apparatus in which an animal or a man may be placed for a number of hours or days, and the amounts and composition of the excreta, solid, liquid and gaseous; the amounts and composition of the food and drink and inhaled air; the potential energy of the materials taken into the body and given off from it; the quantity of heat radiated from the body, and the mechanical equivalent of the muscular work done, are all to be measured."

This apparatus includes a so-called respiration chamber. This is practically a box with copper lining. It is 7 feet long, 4 feet wide and 6½ feet high, large enough for a man to live in. It is provided with glass doors, through which the subject enters; and with a chair, table and cot bed. A current of air sufficient for ventilation passes through the box. Arrangements are made for passing in the food and drink and removing the excretory products. The food, drink and excretory products are all carefully weighed, measured and subjected to chemical analysis. The ventilating current of air is measured and analyzed. In this way it is possible to learn just what ma-

terials are taken into the body and what are removed from it. Arrangements are also made for regulating the temperature inside the chamber. In these experiments cold water is passed through tubes in the respiration chamber. These tubes act as absorbers, the heat given off from the body being taken up and carried away by the current of cold water. In this manner the temperature is kept at a point which is comfortable for the occupant at all times. This is the reverse of the system followed in heating houses by means of hot water passed through radiators from which the heat is given off into the rooms. A man can remain in the respiration chamber an indefinite time without particular inconvenience. The experiments thus far made have been of from 2½ to 12 days' duration. The assistant who remained in the chamber during the longest experiment experienced so little inconvenience that he is by no means unwilling to undertake the same task during a period of even longer duration. Observers are at hand day and night. They not only attend to the wants of the subject and supply him with food and drink, but also make the weighings, measurements and analyses needed for the experiment.

THE EXPERIMENTS AND THEIR RESULTS.

These can be best explained by first describing the diet and its nutritive ingredients and then referring to the effects of the food upon the body of the subject. Facts drawn from several of the experiments will be used for this purpose. The first experiment was made with a laboratory janitor. He was a Swede about thirty years old and weighed, without clothing, 148 pounds. He was accustomed to rather active muscular labor, and previous experiments had shown him to be a decidedly 'hearty' eater. He remained two and one-fourth days in the apparatus. He drank water *ad libitum*. His daily food was as follows:

	Ounces.
Cooked meat	4.3
Eggs	3.5
Potatoes	5.3
Bread	8.8
Milk crackers	3.5
Butter	1.1
Cheese	2.7
Milk	35.1
Sugar	0.8
Coffee	10.5
Total	75.6

During the experiment the subject did no work; he read a little, but had extremely little muscular exercise. The diet was necessarily simple because of the labor required for the preparation, measurement and analysis of the foods. It was, however, entirely agreeable to the subject and the quantities were such as he chose. In estimating the quantities of nutritive ingredients of the food it is customary to take into account the protein, fats and carbohydrates and the potential energy or fuel value. The protein compounds which occur, for example, in the lean of meat, white of egg, casein of milk, gluten of wheat, are the so-called tissue-forming substances. They make blood and muscle, bone and brain. The fats include the fat of meat, the fat of butter and milk, the oil of wheat, etc. The carbohydrates are the sugars and starches, such as the starch of bread and potatoes and ordinary sugar. The fuel values are estimated in heat units or calories. The fats and carbohydrates are the chief fuel ingredients of the body, although the protein compounds serve to some extent as fuel. But while the protein compounds can do the work of the fats and carbohydrates in supplying fuel for warmth for the body and for its muscular work, neither fats nor carbohydrates can take the place of the protein in building and repairing the tissues of the body. In considering the nutritive in-

gredients of the food, therefore, we have to take into account the amounts of protein and the fuel values. The daily diet used in this experiment was found to furnish, in digestible form, 4.8 ounces of protein and 2,960 calories of energy. It may be added that coffee, like tea, contains practically no nutrients, except those of the milk and sugar used with it.

Taking into account the food and excreta it is possible to calculate how much protein or fat the body gained or lost per day during the experiment. In the experiment with the diet referred to, the man's body gained about half an ounce of protein and two and one-tenth ounces of fat per day. This shows that the diet was more abundant than was required for the maintenance of his body. In other words, he was supplied with more protein and fuel ingredients than he required. This was not surprising, since during the period of the experiment he performed practically no muscular work, while his diet had been selected in accordance with his ordinary eating habits when he was engaged in his daily labor.

In a second experiment with the same man the diet was reduced, mainly by diminishing the amount of milk from about one quart to one pint per day. The protein was thus reduced to 3.9 ounces and the fuel value of the digested nutrients to 2,650 calories. With this diet the body almost exactly held its own as regards protein, but still gained a small quantity of fat, about half an ounce per day, showing that the food still exceeded the amount needed to supply the wants of the man's body when he was practically at rest. It was calculated that if the amounts of milk, potatoes and butter in his diet had been reduced by one-half the nutrients would have just sufficed to meet his needs under the conditions of the experiment.

In another experiment, which is the most interesting of all, the subject was a young man 23 years of age, rather taller than the laboratory janitor, quite muscular, and weighing 168 pounds without clothing. He had been accustomed for a number of years to school and college life, and later, to the work of an assistant in the college laboratory. This occupation involved but little muscular activity. Previous experiments had shown that he was inclined to eat rather small quantities of food. His daily diet during the experiment was of his own choosing as in the former case. The food materials were as follows:

	Ounces.
Cooked beef.	3.4
Mashed potatoes.	3.5
White bread.	5.4
Brown bread.	8.8
Oat meal.	1.5
Beans.	4.3
Butter.	1.6
Milk.	22.9
Sugar.	0.6
Apples.	4.3
Total.	56.3

The experiment showed that he digested from this food on the average about 3.3 ounces of protein and with it enough fats and carbohydrates to make the fuel value of the digested food 2,500 calories per day.

The experiment was divided into five periods. During the first period ($1\frac{1}{3}$ days) and the fifth ($1\frac{2}{3}$ days) the subject was at rest. He passed more or less of the time in reading, but did nothing to require any considerable exercise of either muscle or brain. The second, third and fourth periods were of 3 days each. During the second period he engaged in severe mental work, partly in calculating the results of experiments and partly in studying a German treatise on physics. The third period was one of absolute rest. The subject sat in his chair or reclined upon the cot bed, but did no reading and moved about as little as possible. In the fourth period he per-

formed severe muscular exercise. During eight hours of each of the 3 days he was engaged in raising and lowering a heavy weight which was suspended by a cord passing over a pulley at the top of the chamber. The work in this case was so severe that he was thoroughly exhausted.

The result showed that the subject during the periods of rest gained about half an ounce of protein and lost not far from the same quantity of fat daily. The diet which was roughly calculated in advance to be very nearly sufficient for the needs of the organism when no considerable amount of work was done proved to have a slight excess of protein and not quite enough fats and carbohydrates. With the severe mental work the results were almost exactly the same. During the 3 days of hard study the organism consumed about the same quantities of nutrients as when it was at rest. Whether this would prove true for a longer period is not certain.

During the period of hard muscular work the results were quite different. As was to be expected, the food did not suffice for the demands of the body. Instead of gaining one-half an ounce, the organism lost about one-sixth of an ounce of protein per day, while the loss of fat reached 6.9 ounces. The fuel value of the materials consumed in the body during the periods of rest and of mental work ranged from 2,600 to 2,700 calories per day, but in the period of muscular work it rose to 4,325 calories. In this case, therefore, the severe muscular work increased the consumption of protein by over half an ounce and the consumption of fats by more than seven ounces per day. The experimenters have estimated the changes which would have been needed in the daily food to make it equal to the demands of the body during the period of muscular work. They calculate, for instance, that if the daily food had been increased by doubling the butter and sugar and adding half a pound of bacon it would have been sufficient.

The chief interest of these experiments, from the practical standpoint is the light they throw upon the ways the food is used in the body and the kinds and amounts that are appropriate for people of different occupations and under different circumstances. Physicians tell us that disease is largely due to errors in diet. It is only by such researches that the exact knowledge can be acquired which is needed to show how our diet can be fitted to the demands of health and strength as well as purse. In addition, the experiments have great scientific interest.

A number of experiments of this kind have been made in Europe, but these are the first in the United States. These investigations are being continued by the Department of Agriculture, and further reports may be expected from time to time.

Thus far we have described only those features of these investigations which included the measurement of the income and outgo of matter and the determination of the fuel value of the food. The fuel value of excretory products was also determined, as well as the energy manifested by the body in the form of heat or external muscular work. For the measurement of the body's energy delicate and elaborate apparatus was devised. Highly interesting results have already been obtained, but so many improvements in the methods and apparatus have suggested themselves during the progress of the work that it has not been deemed advisable to publish the details of this part of the investigation at present.

AN INDUCTION-COIL METHOD FOR X-RAYS.

SINCE sending a note of a new method of operating an induction coil by the discharge of a condenser we have used it for operating X-ray tubes, and find it gives us a

much more powerful means of driving than any method we had heretofore tried. An exposure of one second gives an excellent negative of such common test objects as coins in a purse, and an exposure of five seconds is sufficient to give a negative showing clearly all the bony structure of the hand and wrist, a negative sufficient for the purposes of a surgeon. The best negative of the hand is to be obtained in about 20 seconds, and 45 seconds gives a marked over-exposure. Not only the bones, but the outlines of the cartilaginous and fatty tissues, and the tendons, are shown in a negative from a 25-seconds exposure. We have not had any opportunity to take any photographs through the body, but judging from results given by the flourscope this method gives a far greater penetration of the rays and a much sharper outline of the shadows than any other we have used. The fluorescence is absolutely steady; the pulsations of the heart can be seen with startling clearness, and the outline of the liver and lungs may be sharply distinguished. The details of the bony structure of the trunk are also clearly shown. The ribs appear as tubes rather than solid rods, owing perhaps to the outer portion being more dense than the inner. The processes on the spinal column are well marked. The hand of the observer may be held between the patient under examination and the tube, and a clear image of its bones may be seen even through the most dense portions of the trunk.

The tunstate of calcium crystals glow so brightly as to make the screen have a distinctly granular appearance. Each crystal seems to be separately illuminated like the grains of sand on a piece of coarse sand paper placed in the bright sunlight.

The effect of prolonged running on the tubes is very similar to that of a static machine, only more pronounced. The resistance of a tube may be increased by running with closed spark-gap, making the concave electrode cathode as usual. If the tube be reversed the resistance will be lowered. It is very often found that a tube which has been run hard for some time when allowed to cool will increase in resistance, so as to be beyond the range of the coil. By running such a tube, making the concave electrode anode on the coil a few minutes, the resistance will be lowered. Slight warming will facilitate matters. Again reversing the tube and running with closed spark-gap, the tube may be brought back to its maximum efficiency in a very few minutes. We have repeated this operation five or six times on some of our tubes with good results. It is needless to say that the above applies only to focus tubes with a platinum anode.

The part played by the spark-gap is not yet clear to us, but we have noted the following observations: A spark-gap between spheres is better than one between points. Some tubes will run without a spark-gap, but when the gap is used it should be on the cathode end of the tube. The proper adjustment of a spark-gap may increase the intensity of radiation several hundred per cent.

The platinum anode in the focus tubes which we use becomes red hot, and the whole tube feels warm to the hand. This is true of tubes which do not heat when driven by a 12-plate, 26-inch Wimshurst machine.

As stated in our note of February 17th, we are operating our induction coil by discharging through its primary a condenser which has previously been charged at 220 volts from the lighting mains. This charging and discharging we now accomplish 250 times a second by means of a five-part commutator on the shaft of a small motor. Since the condenser is disconnected from the mains only when it has risen to their voltage, there is no spark ing when it is disconnected; and since

the discharge of the condenser is exceedingly rapid, it has entirely passed before the commutator segment has left the brush leading to the primary. In other words, the condenser brush leaves its commutator segment when both are at 220 volts, and the coil brush leaves its commutator segment when both are at zero. Hence no sparking need occur on the commutator except the slight spark of making circuit.

The great increase in voltage at the terminals of the secondary over that given by the same coil when operated in the ordinary manner is probably due to the exceeding rapidity of discharge of the condenser, and hence the rapid change in the number of lines of force enclosed by the secondary. For each discharge of the condenser there must be a rise and fall of the current in the primary of the induction coil; but, since we get a uni-direction discharge at the secondary, one of these alone, either the rise or fall, must be effective. The reaction of the secondary of the coil tends to increase the rapidity of rise of current in the primary, but tends to retard the fall, moreover, at the instant the condenser is connected to the coil we have 220 v., the potential of the condenser, applied to a circuit of exceedingly low resistance and very small induction, and from this we must get an extremely rapid rise of current. From these considerations alone it appears probable that the secondary discharge is due to rise rather than to the fall of current in the primary.

The volume of the discharge is so great that the ends of the secondary bristle with brush discharges, even when the terminals are within sparking distance of one another, and great care must be taken in insulating the primary from the secondary. There seems, moreover, to be a continual brush discharge from turn to turn of the primary, the nature of which we are unable to determine. If the iron wire of the core be put in a glass tube, and the primary be wound in a single layer about it, and the whole inclosed in a second larger tube, and the space between the tubes be filled with oil, the needed insulation is given.

CHARLES L. NORTON,
RALPH R. LAWRENCE.
ROGERS LABORATORY OF PHYSICS,
MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
BOSTON, March 5, 1897.

NEW YORK STATE SCIENCE TEACHERS' ASSOCIATION, II.

[*Continued from p. 468.*]

WEDNESDAY evening was devoted to the Earth Sciences. Dr. Frank M. McMurry, of the Buffalo School of Pedagogy, read the following paper, written by Professor Ralph S. Tarr, of Cornell.

Place of the Earth Sciences in the Secondary Schools.

The question is raised again and again, shall the earth sciences (geology and physical geography with their subdivisions) have a place in the curriculum of the secondary school? and this has been variously answered. Many schools have properly omitted them from the course, and others are thinking of doing so. I say properly, because, as the subjects have been taught in the majority of cases, it is better to omit than to continue them.

Then again, when the question is under consideration, which of the natural sciences shall have a place in the schools, we very often find the earth sciences excluded, though this was certainly not the case in the report of the Committee of Ten. The reasons given for the exclusion of these subjects from the proposed curriculum are usually two: first, that they are not disciplinary subjects; and second, that for their proper understanding they need too much knowledge of other sciences. The first grows out of a failure to appreciate that there has been progress in the methods of teaching the earth sciences, a progress

which the critics have evidently not yet learned about, but which nevertheless has been most marked and important. The second conclusion of the critics is based in part upon this misunderstanding, and in part upon the misinterpretation of the possibilities embraced within the earth sciences. There is no subject of natural science which, for study of an advanced character, does not require a knowledge beyond the present ability of the secondary schools to give. We do not find it necessary to omit these sciences for this reason, but merely the part that presents the difficulty. Why does not the same principle apply to the earth sciences? Even when this exclusion of parts has been made, there is enough left.

It is my belief that no science is better adapted for the beginning in science study in the secondary schools than physical geography. There are two reasons for this belief. In the first place, of all the criticisms made against the science instruction in the schools, the one that appeals most strongly to my mind is that there is too much smattering and jumping about from one thing to another, before any real knowledge of any science has been gained. There is an effort to obtain wide information on various topics, with the result that almost no training is gained, and so much information is poured in that the mind of the student is necessarily confused. Physical geography is a direct extension of the geography study which has been carried on for years before in the lower grades. With this geography properly taught, and physical geography made an advanced continuation of this, there is at least one year added to the consecutive study of what may be properly considered closely allied subjects belonging to the same group.

The second reason for considering physical geography adapted, above all the other natural sciences, to first year study is that, when properly handled, it arouses a general interest which no other science does so well. That this point is correct I have long known, but never before have I so fully realized it as when, a few weeks ago, I visited a number of the Chicago high schools, where physical geography is being taught in the modern way. The eager interest, the evidence of acute observation and clear thinking, and the intelligent questions asked by boys in knickerbockers and girls just fresh from the grammar school, was the best proof I have ever seen of the truth of this conclusion. The teachers, forty in number, assured me in conference that no other subject aroused so much interest as that of physical geography, and this came from teachers most of whom were especially interested either in biology or physics.

This fact of interest I make a central point of the argument, because it is the means for obtaining an end. The old instruction in physical geography has for its object the imparting of information. The new school endeavors to make it a subject of disciplinary value. Observation is encouraged and, in fact, insisted upon. The results of these observations and of other groups of facts are placed together to make explanations. Weak arguments are tested and overthrown; fallacies are discovered and pointed out, and the subject is hence made to train habits of the mind which every high school pupil will need, if he lives by even a partial use of his mental powers. We need to know how to use and discover facts, and then to understand what they mean. The proper study of physical geography helps to train these habits of mind. No better means for gaining such a discipline can be found than to arouse the interest of the pupils. With interest, or, better still, with enthusiasm, the pupil observes and thinks beyond the requirements of the study and plies his teacher with questions, sometimes of great ingenuity.

Incidentally, however, he gains information; and I believe that much more of this is obtained by this means, and that this is much more firmly rooted in the mind than is the case when the main idea is the accumulation of the mere information which anyone can get from an encyclopedia or a dictionary.

If we are willing to grant that the earth sciences have a claim for a place in the secondary schools equal to that of the biological and physical groups, the question arises, how shall they be taught? This is, of course, a question which cannot be answered in a few words. We are confronted at once with the difficulty that the ideal at present seems impracticable. Nevertheless, I am going to dwell especially upon the ideal, believing that if this is set, and an effort is made to reach it, more progress will be made than if we are content to be held down to what seems to be practicable.

This matter is treated mainly from the standpoint of the colleges, though not without recognizing the fact that but a small number of the high school pupils enter the college; but in the belief that what is desired by the college is also best for the boy whose systematic education ends in the high school; and also because it seems that the college, by setting the standard, can mould and lead public opinion even in a new direction, provided, of course, there is also hearty sympathy and support from the teachers in the schools. If between us we can decide upon something, we can in time carry our point; but if we act independently, and along different lines, progress will be slow, indeed.

I am certain that I voice the sentiment of most of the college scientific teachers who have thought upon the subject when I say that the prime need in education today is some change in the college-entrance subjects which have so long served as standards. The world has been progressing, and even the college, one of the slowest of institutions to depart from tradition and precedent, is beginning to take cognizance of this. Natural science instruction is demanded by the people who support the schools, and so far the colleges have retarded the proper fulfillment of this demand, by so occupying the time of the student with other subjects, that natural science has been possible only in very small doses. The attempt has been made to supply the demand for information, but in most cases there has been but little more.

The science teacher of the college also needs and asks for more adequate science in the secondary schools. For my own part I am obliged every year to teach college students the simplest habits of observation, which might better have been learned in the kindergarten. To turn a boy out into the world trained in Latin, Greek and mathematics, and yet unable to use his own eyes or think with his own brain, is not treating him fairly. He is very poorly prepared to compete with the keen, shrewd intellect of some business man whose boyhood days were spent not in school, but in gaining a mental training from nature on a farm, or from men in that great, heartless school of affairs. To me it seems that the parents are demanding a knowledge of science; the pupil, whatever his chosen vocation, needs the training, and the college science teacher needs to have his students come to him with a better preliminary training.

Really valuable discipline in science, properly comparable to that gained from the classics or mathematics, cannot be obtained from courses of fourteen weeks each. Nor can it even be gained by courses of a year each. This is one of the points that prevents the science teacher of the college from making progress in his efforts to introduce science into the list of college-entrance requirements. He is immediately con-

fronted by the query whether the science instruction is really comparable with that of the stock entrance subjects; and he is forced to admit that it is not.

The reason why he must make this admission, which is fatal to his efforts, are first, that time enough is not given to any one subject or group, and that the method of teaching is generally not equally good. To be really comparable with Latin in disciplinary value, some one of the sciences, or group of allied sciences, should be taught consecutively for at least two or three years by means of laboratory methods, which call for expensive apparatus.

This is the ideal, but there are practical difficulties. The parents call for more than one science, and the committeemen are not willing to furnish the money for the necessary equipment. I have considered these difficulties elsewhere, and proposed a plan of compromise,* which is briefly to have *all* sciences represented in the course, but to have some *one* taught as a major subject, according to the best methods, and as a consecutive study covering not less than two years. Ultimately, when the benefits of a proper study of one science are shown, the school may see its way clear to the introduction of similar study of others; but I believe that one science properly taught is better by far than several poorly handled, as, of necessity, so often happens at present.† Which group is chosen seems to me of little importance.

I feel certain that the larger colleges of the country will stand ready to accept a properly taught science as an entrance alternative fully equivalent to advanced Latin, Greek or mathematics. There is no reason why it should not be considered an equivalent; and if the colleges can be assured that proper teaching and discipline is possible in the schools, the move can certainly be made. However, having set what seems to me the ideal, I must say that I think we shall find it necessary to start far short of it, though always moving toward it. One cannot change radically and suddenly; there are many questions to be considered, not all of which are familiar to the college teacher. Hence I believe it will be necessary to adopt a compromise course, with the distinct understanding that we are moving toward the higher end. Let us have four years of science taught as nearly as possible by laboratory methods. It would not be necessary for all students to take four years, but insist upon *everyone* having not less than one year of genuine science instruction. For those who, by choice, take a course which allows of consecutive study for four years it would, perhaps, be better to have this kept along the line of some allied subjects; but, as this is hardly possible, the instruction should be confined within as narrow limits of subject-matter as possible.

Because of the interest which it arouses in science subjects, and the training which it furnishes to the important powers of observation and reasoning, physical geography is the best adapted of the sciences for the basal study. Moreover, numerous experiments have proved that it fits admirably into the first-year curriculum. It would be well if this could be supplemented and continued during the second year by a study of geology, which is so closely allied to it; but, perhaps, in most cases the demand for instruction in the biological and physical sciences will be so great that this will not be possible.

*Educational Review.

†I have recently had an application for a teacher of physical geography; and when it become known, a number of students have come to me; one of them, a former teacher, when I said that a real knowledge of physical geography was needed, replied, that she had taught nearly everything, and could do so in the future, and that she would be ashamed of herself if she could not teach so simple a subject as physical geography.

If the schools will offer genuine science instruction the colleges will no doubt accept it, and thus lend encouragement to the schools in their effort to give such instruction. Why should not a minimum science *entrance requirement* be set by the college, leaving the subject elective, but demanding that every student on entrance shall have had at least one year of *genuine disciplinary* science instruction; then, as one of the alternative requirements, allow the acceptance of advanced science study in the place, let us say of Greek or advanced mathematics, etc. Four years of properly conducted science study gives as valuable a training and culture, even though this be of a somewhat different kind, as an equal time spent in the study of German, Latin or mathematics. The colleges which permit election of studies are practically committed to the theory that each subject well taught in the college is as valuable as any other.

The science instruction, both in the elementary and the advanced study, must be of the best if it would meet this requirement, and the teacher must know and have an interest in the subject which he teaches. No one can have an adequate knowledge of all the natural sciences, and it is unfair to ask a teacher to give instruction in them all. As time goes on this will be remedied, provided we can inaugurate a movement to improve science instruction; for such an improvement all along the line means, of necessity, more teachers. Therefore, it seems well for the present that the science teacher should be selected with special reference to his ability to give good instruction in *one* subject; and this he should be allowed to develop, as far as he can, with the constant effort to obtain higher grade work in at least one line of natural science. Well trained in one subject he will be a better teacher of the others than if he was equally well prepared in all sciences.

Very little has been said of physical geography, because it has seemed to me that there is a more important point pertaining to all sciences. I feel that it matters little whether the science instruction be in physical geography, physics, chemistry or biology, so long as it is genuine science instruction. That physical geography has a claim equal to the others can be demonstrated. To teach it in such a way that I would be willing to accept it as a subject for entrance to Cornell University there must be very much more than book work. The attempt to gain information must be subordinated to the effort to train the powers of observation, the habit of inquiry and ability to reason out valid conclusions from an assemblage of facts.

This training must in large part be gained by practice in the laboratory and in the field. The air, earth and water, the natural laboratories of physical geography, are accessible to all. They have lessons to teach, and furnish means for discipline of the nature suggested. The natural laboratory is not always accessible, nor are all features of physical geography capable of illustration in every instance. Hence, out-of-door work must be very decidedly supplemented by work within doors. We cannot, for instance, take many classes to a glacier. Models, maps, photographs and lantern slides must take the place of some features of the actual land. These are not so good as the real out-of-door examples, but, skillfully handled, they illustrate the facts well, and serve well as a means of gaining important training. In geology the same means may be used and these may be supplemented by the study of specimens of various kinds. Much material for this instruction is accessible and cheap, and schools that would make the study of physiographic subjects of disciplinary value must equip a laboratory with these materials. It is now no more possible to teach physical geography properly by means

of mere recitations than it is to give desirable instruction in chemistry or physics in this old-fashioned way.

The entrance examination in physical geography should then not be merely a set of questions upon the subject matter of a book, but also questions concerning the physical features of the neighborhood, and others which should prove the ability of the student to observe and to think. This should be supplemented by a note-book containing the record of the laboratory work actually done.

This is a statement of my conception of the results which we are to aim to obtain. How we shall reach the desired end is quite another matter, and one which certainly cannot be considered here. If we can become agreed concerning the goal, the means of approaching it, or even reaching it, will be found. I believe that we should first of all lay down a wise plan, and then try to follow it. A committee should be appointed to consider various suggestions and decide upon the best; then bring it before the society. After the plan is finally decided upon, the concentrated effort of our members will make it a success, provided it is a wise plan.

I have, therefore, spoken rather concerning the principle at large than concerning the particular claims of physical geography, or the means by which instruction in this can be given. The subject has claims which in any wisely made plan of procedure must be recognized. If it seems necessary to go over these claims it can be done. The subject offers a means of furnishing valuable discipline. Already enough has been written upon this subject to serve as a basis to guide the teachers along the proper line of advance in the mode of instruction in physical geography.

Discussion—The Earth Sciences. By RICHARD E. DODGE.

The Earth Sciences, including meteorology, geology and physiography, should most emphatically have a prominent place in the curriculum of the secondary and grade schools, for many reasons. They are capable of arousing the best mental faculties; they train observation and reasoning; they bring the child more closely in contact and sympathy with the world about him than do any other group of sciences. Once love for nature is aroused, the stimulation for deeper study follows without fail.

In the study of this group of sciences, as well as in all other sciences, the training should be largely by the laboratory method, and the laboratory should be out of doors as far as possible. In the progress of the work, the study of facts and the representations of facts should be augmented by a series of developmental exercises designed to lead up to and develop principles.

The method to be employed depends largely upon the personality and ability of the teacher, and no one method can be prescribed as a sure panacea for all ills of science teaching. Each teacher must aim to bring out scientific principles by some method demanding reasoning on the part of the pupil and causing advance from the simple to the complex. My experience has shown that such aims can well be accomplished if the facts be given by making the pupil solve a progressive series of related problems, each problem being solved through a similar series of related questions. The advance is thus by steps toward the end sought, each step being secured by a focalization of ideas toward the point in mind. Such a method of presentation is rational and scientific and is as capable of application in the grades as in the higher schools.

The simpler facts and principles should be crowded back from the high into the lower schools, and we cannot better the work in the higher schools until we have made the proper beginnings in sciences in

early youth. In such introductory work, we should aim for intensive and not extensive work, to give the ability to gain further information rather than mere knowledge of unrelated and incomplete facts, as is so often done.

Considering these as our aims, what should we aim to give for subject matter in each of the sciences under consideration?

In meteorology we should aim to give an understanding of the winds, precipitation, insolation, weather, climate, etc., and the dependence of life on climatic conditions. This work should be by the laboratory method, making use of the ever-present weather conditions and of maps, charts, weather maps and instruments of measurement.

In geology we should devote most attention to observational study of dynamical geology. Minerals, rocks and fossils should be studied only so far as they give a better understanding of the fundamental characters of the rocks themselves, except in those localities where there are fossiliferous rocks, where, of course, more stress can be laid on those subjects. The life processes of the earth and their results are the most rational, interesting and helpful features of geology to the beginner. In this science, as in any other, if function be made the causal condition and form the result, we have a rational arrangement of subject, and we at once elicit the confidence and sympathy of the pupil. The inorganic becomes alive and the dead sciences are no longer dead, but equally alive with the organic sciences.

In physiography earth forms should be studied, their origin, their relations and the dependence of life upon them. This is a broad and ever broadening field, and in it we can come more closely in contact with the world about us than in any other sciences. The application of the principles to the understanding of human history and progress offers a possible field of study that is almost inexhaustible and inspiring to the highest degree. Descriptive, political and commercial geography gains its greatest value when some understanding of the climatic and topographic determining conditions has been gained previously. Descriptive geography with no knowledge of the origin of land forms is like anatomy with no knowledge of the skeleton, which is the basis of anatomy. In this study a mere study of geographic distributions is not enough. The study should largely be one of comparison and of relation.

The science—for physiography is a science—thus becomes not only of value for itself, but also because of the light it casts upon the study of other subjects in the curriculum.

Such are some of the possibilities of the earth sciences if they be studied in a common-sense way. We must acknowledge that at present most teachers are not prepared to treat these sciences, so commonly called easy, in a scientific and broad way. One of our tasks is to see what can be done to give the secondary school and grade school teachers a better ability to teach the earth sciences with a scientific understanding.

Professor Albert P. Brigham, of Colgate University, emphasized the lack of training in observation on the part of students coming to the earth sciences in the upper years of the college course. This is more to be regretted since the subject is capable of graded presentation in all stages of education. Interest is absolutely to be depended upon in children or adults when earth facts are explained in a rational and simple manner. It is a grave loss if that great company who never go above the grades must go out ignorant of the common facts of out-of-door nature and of the earth materials upon which our daily life is dependent. Let us insist that geography is a

genetic science, vital, causal, evolutionary. Nor may we neglect the moral and æsthetic value of these studies. This is the work of the teacher who knows, who has a horizon, who can arouse and inspire.

Professor Charles S. Prosser, of Union, advocated the thorough teaching of geography in the grammar schools, suggesting the use of such a work as Frye's which should be followed in the high school by physical geography. The class-room work should be supplemented by excursions to localities in the neighborhood affording illustrations of some of the features of physiography.

It is now found that a portion of the college students when taken on geological field trips are indifferent to the illustrations of geologic structure. The early interest of boys in objects to be found in field and forest seems to have become atrophied, a condition of mind said by Professor Shaler to be due to super-civilization. This is more apparent in the students coming from large cities than in those from the smaller cities and villages. It was stated by the great teacher of geology—Professor Dana—that as a rule the students who mastered geology were those who had spent a considerable portion of their boyhood in the country. It was emphasized that this power to observe would be greatly developed by a high-school course, using such a work as Tarr's Elementary Physical Geography.

Professor E. C. Quereau, of Syracuse University, spoke on the need of correlation of the university and the secondary school work in physical geography. The geography taught in the lower schools has been too much descriptive and locative, the pupil being required to memorize geographical features, while the work which has been taken up in the college and university in later years has been a study of the origin and progressive changes of the surface features of the earth and their vital relations to the needs of man. A better correlation of the work, from the secondary school up to the college, would be an advantage.

Dr. Frank McMurry, of Buffalo, argued that mental discipline is not the highest aim in the study of the earth sciences in the high school curriculum. The great object to be emphasized in teaching literature, history, and nature study in the common school is inspiration. They arouse the whole mind, develop life-long tastes or loves, and hence become permanent sources of energy and mental life. The ability to arouse a great love for nature is the greatest object in bringing physical geography into the curriculum. It is a much nobler, higher purpose than discipline or information. This study can excite this love, because in it inductive work can be done; it can be concrete, and the laws involved can be reached through abundant data. Then, too, these data stand related in a causal way; they can fall into a causal series, a series in which function can take the lead and be more prominent than form. Further than that, as said by Professor Dodge, the whole subject can be approached through *problems*, and one series of problems can lead to another and higher series.

It is plain, then, that this is a science in which the subject matter is so arranged that it can be a source of great mental life; that is why this subject is so valuable. Life is controlled by loves, by tastes, and this subject is able to generate a great love for one field of nature.

Careful consideration of this science and proper teaching of it will ultimately influence greatly the teaching of geography in the grades. If we can once establish the conviction that the earth is alive and changing and active it can affect the teacher's attitude toward the grade work. Possibly at last physical geography can precede the book work in geography. This,

then, is also a reason for urging the importance of the earth sciences as a proper high school study.

Professor I. P. Bishop, of the Buffalo Normal, spoke of the importance of geology in the teaching of geography. Whether it be included in the school course or not, there is no doubt that it should form an essential part of the geography teacher's outfit. For it is manifestly impossible to teach the detached facts of physical geography so as to give them much educational value without knowing the causal relations upon which the significance of these facts depends.

It is not so difficult to obtain material for this kind of nature work as is often imagined ; the true way is to study the material nearest at hand. Every gravel bank is a museum. Every stream, even to the tiny rivulet formed by a shower, illustrates the carving of a river valley or a Niagara gorge. In almost any village we can show how a hard layer of rock in the bed of a stream has made a waterfall, cascade, or rapid ; how by the aid of a dam this has been utilized to run a saw or grist mill ; how this has then naturally become a favorable spot in time for the location of a store, blacksmith shop, hotel, churches, schools, and the other interests of such a community. Thus the material available almost anywhere serves to illustrate the mutual relation between a country and its people.

Professor B. G. Wilder, of Cornell, recalled with dissatisfaction the time and energy expended by him during his earlier school days in the memorizing of many geographic names of comparatively insignificant localities, and held that in a natural order physical geography should precede rather than follow the ordinary political geography. He also believed that if, between 1860 and 1870, the study of physical geography had been carried even as far as at present, so that the public, and especially the clergy, could have realized that the apparently stable earth is really a sort of cosmic organism still in process of development, the acceptance of evolution might have required only a decade instead of the quarter of a century.

The discussion turned upon the best means of conducting excursions for the study of the earth sciences. It was admitted that in most schools too little attention is paid to this phase of the work. Teachers are too apt to strive for an interest in far-away matters, glaciers, trade winds and ocean currents, while they neglect the means that are nearest at hand for arousing and developing an interest in the earth. At the same time there were many expressions of warm appreciation of the work in some of our secondary schools, and in the grades as well. Reference was also made to the great assistance rendered by the American Museum of Natural History in its distribution of lantern slides to the schools of the State.

Mr. William F. Langworthy, of Colgate Academy, speaking of the teachers of geography in our grammar schools, said that their failure to accomplish better results in the direction of modern methods is not so much their own fault as the fault of those who have trained them, of those who have charge of our courses of study. Much time is lost in the lower grades upon some parts of arithmetic. If some of the more advanced portions of arithmetic were taken up in the later years of the high school course, or in college, it would leave more time for geography in the grades ; but it is not advisable to crowd any more work into the grammar school course. It is better to enrich the grammar school course than to enlarge it.

The other speakers were Dr. D. L. Bardwell, of the Cortland Normal ; Professor H. J. Schmitz, of the Geneseo Normal; Dr. T. B.

Stowell, of the Potsdam Normal; Professor William Hallock, of Columbia; Professor C. C. Wilcox, of Starkey Seminary; Professor Henry L. Griffis, of the New Paltz Normal; Miss Sherman, of Ithaca High School; Professor E. R. Whitney, of Binghamton; Mr. Charles N. Cobb, of the Regents' Office; Principal S. G. Harris, of Baldwinsville; Dr. Charles W. Hargitt, of Syracuse University; Mrs. S. H. Gage, of Ithaca; Professor Warren Mann, of Potsdam Normal; Principal Henry Pease, of Medina; Professor O. D. Clark, of the Boys' High School, Brooklyn, and Principal Henry S. Purdy, of Brewster.

FRANKLIN W. BARROWS.

BUFFALO, N. Y. *Secretary.*

(*To be Concluded.*)

CURRENT NOTES ON PHYSIOGRAPHY.

TENNESSEE VALLEY REGION, ALA.

A RECENT report for the Geological Survey of Alabama by Henry McCalley, on 'the Tennessee valley region,' contains a general description of the paleozoic area in the northern part of the State, excepting the Coosa valley district, which is reserved for a later volume. Account is given of the level sandstone uplands, or 'barrens,' in the northwest corner of the State; and of the rolling limestone lowlands with rich red soil in the valley of the Tennessee river; these two districts being the higher and lower parts of the dissected uplands which enter from Tennessee. Next to the east rise the table mountains of the dissected Cumberland (Allegheny) plateau. The waters of the tables often disappear in sinks, and reappear in large springs at the head of coves on the flanks of the 'mountains.' South of the Tennessee, Little and Sand mountains are monoclines or cuestas, with steep and ragged escarpments to the north and gentle slopes to the south. The broad flat 'Moulton and Russellville' valley lies between them, trending east and west. The Sequatchee valley of Tennessee is called Brown Valley in Alabama, and limits the preceding divisions on the east; it is excavated on an unsymmetrical anticline. An outline map locating these areas would have added much to the ease of interpreting the text. Most of the report is concerned with stratigraphic and economic geology; the illustrations are chiefly of quarries.

THE PREGLACIAL KANAWHA AGAIN.

REFERENCE should have been made, in a recent note on the Preglacial Kanawha, to the studies of Professor W. G. Tight, of Granville, Ohio, and of Professor I. C. White, of Morgantown, W. Va., regarding the changes in river courses of Pennsylvania and Ohio on account of obstructions by ice and drift. An article by the last named writer (Origin of the high terrace deposits of the Monongahela river, Amer. Geol., XVIII., 1896, 368–379) should have been cited, along with the note regarding Leverett's work from the Report of the Director of the United States Geological Survey; for both are concerned with identical problems. White describes several channels among the hills of the Allegheny plateau, where the waters of the impounded Monongahela for a time ran over cols; one of these channels being permanently adopted in the present course of the Ohio. When this region is mapped and studied in detail it promises to reveal features of peculiar interest in connection with the rearrangements of river courses by glacial action.

STAGES OF APPALACHIAN EROSION.

ALTHOUGH this series of notes cannot pretend to completeness, it has been the writer's intention to report here on all the more important American essays, and on certain foreign essays that are relevant to modern physiography. It was entirely by oversight that an abstract of Keith's brief

article on 'Some stages of Appalachian erosion' (Bull. Geol. Soc. Amer., VII., 1896, 519–525) was omitted from earlier notice. A tardy note upon it is therefore now presented. Keith contends against the conclusion of Hayes and Campbell regarding the warping of the Cretaceous and Tertiary Appalachian peneplains; he maintains that river basins at different distances from the sea must, in similar rocks and at similar stages of denudation, produce peneplains of different altitudes and of different inclinations; and that part of the inequality of altitude and attitude that was explained by the earlier authors as a result of warping is better explained as a result of difference of distance to the sea. The slopes of a number of peneplains, thus interpreted, is generally so slight that their present altitude is better accounted for by nearly uniform uplift than by pronounced warping. A fuller discussion of the problem is promised. We may then see it illustrated and argued with the detail that so important a matter deserves.

It may be noted that in New England a tilting of the Cretaceous peneplain of the uplands from its former lower and nearly level attitude is well proved; for the submature rivers of to-day run to the sea on flatter grades than the descent of the uplands; and this would be impossible if the peneplain had not been distinctly tilted.

BALTZER ON THE DILUVIAL AAR GLACIER.

THE thirteenth number of the Beiträge zur Geologischen Karte der Schweiz is a treatise on the diluvial glacier of the Aar and its deposits in the neighborhood of Berne, by Professor A. Baltzer of that city. It is a handsome quarto volume of 170 pages and seventeen plates. The text is chiefly concerned with the results of glacial action in the neighborhood of the strong terminal moraines and the included amphitheatre of Belp (just above Berne). This amphitheatre was in general eroded; the moraines outside of it were built up; and the forelying district was broadly aggraded by surcharged glacial rivers. The chief of the latter was the Aar, which shifted its course to the right and left across the foreland, as one part after another was sheeted with sands and gravels. Among the plates special mention should be made of a superb view showing the confluence of the two main glacial branches far up among the mountains, from a photograph by Sella; a pictorial section exhibiting the dimensions of the whole length of the diluvial glacier when it extended even beyond Berne; and several views of the drift topography in the piedment district. The effect of the Rhone glacier in obstructing the natural outflow of the Aar glacier and requiring it to run over the Brunig pass towards Lucerne is clearly set forth. A large two-sheet map of the district about Berne will prove a a valuable guide to foreign students who wish to examine a typical glaciated area in the light of detailed local investigations.

W. M. DAVIS.

HARVARD UNIVERSITY.

CURRENT NOTES ON METEOROLOGY.

THE TEACHING OF CLIMATOLOGY IN MEDICAL SCHOOLS.

THE importance of a study of climatology by medical students is urged in a paper by R. DeC. Ward, under the above title, in the *Boston Medical and Surgical Journal* for February 4th. At present very little attention is paid to this subject in any of our medical schools, and a special course in climatology is given in but about half a dozen. Medical men all realize the close relations which exist between climatic conditions and health, but, so long as no instruction is provided for them during their medical course, they are left to pursue the subject as best they can after they begin to practise. In this paper a general outline of

a course in meteorology and climatology, suitable for medical schools, is given, and reference is made to the books which will be found most useful in the work. The writer believes that the subject of climatology is of sufficient importance to stand by itself, as an independent course in the medical curriculum, and that every medical student should have a general knowledge of it. The special relations of climate in the different branches of medicine can be discussed by the instructors in hygiene, or therapeutics, or bacteriology, after the students have the general knowledge just referred to. Correspondence has shown that a large number of the deans of our medical schools favor the giving of some such instruction in climatology in the medical course, and there can be no doubt that all the most progressive schools of medicine will provide such instruction before long.

SUNSTROKE WEATHER OF AUGUST, 1896.

WE are reminded of the exceptionally hot weather which prevailed over the eastern two-thirds of the United States early last August, by a paper by Dr. W. F. R. Phillips, entitled 'Sunstroke Weather of August, 1896,' in the November *Monthly Weather Review*. The opportunity which this extraordinary heat wave offered, of studying the relations of meteorologic conditions and the occurrence of sunstroke, was made good use of by our Weather Bureau, and, as a result of a careful study, Dr. Phillips has been able to draw some interesting conclusions from the large body of hospital and official city statistics collected. The most important results are as follows: (a) the number of sunstrokes follows more closely the excess of temperature above the normal than it does that of any other meteorological condition; (b) the number of sunstrokes does not appear to sustain any definite relation to the relative humidity; (c) although the absolute humidity was greatest during the maximum of sunstrokes, yet it does not appear that the variations influenced the number of cases; (d) the liability to sunstroke increases in proportion as the mean temperature of the day approaches the normal maximum temperature for that day. It is rather striking to find no decided connection between the humidity of the atmosphere and the occurrence of sunstroke. So far as can be ascertained, the whole number of deaths during August, 1896, directly attributable to sunstroke was 2,038.

DEFORESTATION AND RAINFALL.

Nature for January 28th contains a note on the much vexed question of the influence of forests on rainfall. According to a recent *Bulletin of the Royal Botanic Gardens*, Trinidad, the rainfall on that island is slowly but surely decreasing. The average rainfall for the decade 1862–71 was 66.715 inches; for 1872–81, 65.993 inches, and for 1882–91, 65.037 inches. The cause of this decrease is said to be the disappearance of the forests. It would be well, however, to wait a good many years more before coming to that conclusion. Records for only thirty years, even if they are absolutely comparable and reliable, are hardly sufficient to warrant holding such a belief at the present time.

R. DEC. WARD.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

THE EUROPEAN 'QUATERNARY' MAN.

OUR geologists rarely use the term 'quaternary.' By European writers it is understood to mean the period which followed the Tertiary and includes the present time. Archæologically it is divided into two epochs, the older including the pre-glacial, the glacial and the post-glacial ages, all characterized by a chipped-stone industry; the later beginning with the neolithic culture and continuing till now.

Professor Gabriel de Mortillet, in the *Revue Mensuelle* of the Paris School of Anthropology (January 15), succinctly explains these divisions and sets forth, with his usual clearness, the typical products and the fauna which characterize them. He has found no reason materially to modify the opinions he advanced in his earlier works, and still maintains that a careful study of the geological data bearing on the question of the antiquity of man does not allow us to assign it a more recent date than 230,000 years ago.

THE AFRICAN DWARFS.

In the *Mittheilungen* of the Vienna Anthropological Society, for December, Professor Paulitschke presents his views on the dwarfs of Africa. He referred to the present localities occupied by them, which are scattered from the Atlas chain in Morocco to the Kalehari desert in South Africa. For a variety of reasons, he believes these dwarfs to be the remnants of a distinct race, not degenerates, but a 'sport' (*Spielart*) of *Homo Sapiens*, which at some distant epoch occupied large areas of the continent and extended to Madagascar.

Referring to the Dume, the small people found by Dr. Donaldson Smith north of Lake Stephanie, he regretted that so little information was secured about them. But Dr. Smith did obtain a vocabulary of their language and photographs of two of the males, which are printed in his recent volume of explorations.

D. G. Brinton.
University of Pennsylvania.

SCIENTIFIC NOTES AND NEWS.

A BILL FOR THE SUPPRESSION OF SCIENCE, LITERATURE AND ART.

The new tariff bill now before Congress imposes a tax of 45 per cent. *ad valorem* on scientific apparatus 'imported especially for colleges and other institutions;' it imposes a tax of 25 per cent. on books imported for public libraries, on books 'printed in languages other than English,' on books 'printed more than twenty years,' and on books 'devoted to original scientific research,' and it imposes a tax of 25 per cent. on works of art. This simple statement is the most severe indictment that can be brought against these provisions of the bill. Argument in such a case seems almost useless.

Import duties are imposed in order to raise revenue and, according to one of our political parties, to protect home industries from foreign competition. Indirect taxes for purposes of revenue are by common consent imposed on those articles whose consumption is not necessary nor useful. Thus the British government collects an import duty only on stimulants, narcotics and silverware. The United States government collects internal revenue only on alcoholic drinks, tobacco, opium, oleomargarine and playing cards. Opposed to such commodities are scientific instruments and books, which contribute the most to the advance of civilization. A single scientific instrument or the book describing it may increase the wealth of the country by millions of dollars. It is inconceivable that any government should deliberately impose a special tax on such an instrument or book for purposes of revenue.

We must suppose that if anyone approve these new duties it is on the ground of protection to home industries—that, for example, they will benefit our instrument makers. But it seems evident that makers of apparatus will be injured by such taxes. If a college must pay 45 per cent. to the government for the apparatus that it imports it will have less to spend on domestic as well as on foreign instruments. If the best models cannot be imported from abroad, and if American men of science are prevented from improving instruments and inventing new ones, the makers of apparatus in the United States will suffer severely.

But a more important consideration remains. Those who believe in the protection by government of home industries undoubtedly must regard as most important the protection of the industry that contributes the most to the welfare and development of the nation. Agriculture, manufactures and commerce depend on sci-

entific work. It is only by keeping fully abreast of the scientific progress of the world and by contributing its share to this progress that the United States can maintain a position equal to that of Great Britain and Germany. We can afford to confine our considerations to material wealth, even though we may regard as far more important than this, health of body, intellectual development and moral balance. Even those who wish to limit the paternal functions of government believe that it should encourage education and science. It seems incredible that a bill intended to protect the industries of the United States, enacted by a party representing a large part of the intelligence of the nation, should contain provisions tending to suppress science, literature and art.

The President and faculties of Yale University have presented a petition against these duties, and this example should be followed by other institutions. Men of science should also write individually to their Representatives in Congress. When the character of such taxes is properly understood, the bill containing them can scarcely be passed by Congress and signed by the President.

GENERAL.

THE forcible arguments urged by Lord Lister and other members of the recent deputation to the British Prime Minister on the question of the establishment of a National Physical Laboratory apply equally to a similar institution at Washington. We may especially call attention to the able advocacy of this plan by Professor F. W. Clarke in this JOURNAL (January 22d). A department that will do for the manufactures and commerce of the nation what the Department of Agriculture now does for the agricultural interests might properly begin with an institution at Washington similar to the German *Reichsanstalt* and the National Physical Laboratory now urged by English men of science.

IN view of the present advocacy of a department of health under our government, it may be worth noting that the *Lancet* commends a similar plan for Great Britain, proposing that there be a minister of health with a seat in the Cabinet having charge of the following departments: (1) The Registration Department; (2) the Local Government Department; (3) the Factory and Workshop Department; (4) the Analytical and Chemical Department; (5) the Veterinary Department; (6) the Public Works and Prisons Departments; and (7) the Lunacy Department.

MR. JOSEPH H. BRIGHAM has been appointed Assistant Secretary of Agriculture. According to the biographical notice in the New York *Evening Post* his qualifications for the office are as follows: "The new Assistant Secretary of Agriculture is a farmer living near Delta, O., in the western part of the State. He has an excellent war record as an officer in the Union army, and is well known in Ohio political circles, having been his party's nominee in several hot fights. Among the agriculturists he is widely known as Master of the Grange, which office he held for some time. He has lectured to granges in all parts of the country, and was warmly endorsed by granges for Secretary of Agriculture. He is six feet five inches tall. In the Harrison administration he was one of the commissioners to negotiate with the Shoshone and Arapahoe Indians for a cession of a part of the Wild River Reservation in Wyoming."

MR. ROBERT T. HILL, of the United States Geological Survey, has just returned from the fourth of a series of annual studies in the Tropical American regions, made under the auspices of Professor A. Agassiz. The present expedition was devoted to a further study of the geology, paleontology and geomorphology of the Antilles, Barbadoes and the Leeward Islands, and their relations to continental problems. Mr. Hill reports that much new and valuable information was obtained upon these subjects.

MR. S. F. EMMONS, also of the Survey, is in South America, under a month's furlough, working in mining geology.

HENRY L. MARINDIN, an assistant in the Coast and Geodetic Survey, has been appointed a member of the Mississippi River Commission.

IT is proposed to erect a memorial to Galileo Ferreris, the eminent student of electrical science, in the Industrial Museum at Turin. A strong committee has been formed for the purpose, including a number of leading Italian

statesmen and men of science. It is intended to make the memorial international. Subscriptions should be sent to Sig. Cav. Zappata, the municipal Treasurer of Turin.

OXFORD University conferred the degree of D. C. L. on Dr. Nansen on March 18th.

DR. FELIX KLEIN, professor of mathematics at Göttingen, received the degree of D. Sc. from Cambridge University on March 11th.

PROFESSOR E. E. BARNARD, of the Yerkes Observatory, has returned to America. Owing to stormy weather the steamship arrived a day late for the annual meeting of the Royal Astronomical Society, but a special informal meeting of the Society was arranged on March 2d for the presentation of the gold medal awarded to Professor Barnard.

GENERAL SEBERT has been elected member of the section of mechanics of the Paris Academy in the room of M. Resal.

M. GAILLOT has been appointed successor of M. Loevy as sub-director of the Paris Observatory.

IT is stated in *Nature* that Professor W. Ramsay has been elected a corresponding member of the Royal Academy of Bohemia and of the Academy of Sciences of Turin.

MR. HERBERT SPENCER, in accordance with his uniform practice of declining honors, will not accept the degree of D. Sc., which the Council of the Senate of the University of Cambridge proposed to confer on him.

A MEMORIAL to Professor Jaccard, who held the chair of geology at the Academy at Neuchâtel until 1895, has been unveiled at the Academy.

A PROFESSOR of natural science is wanted for the Thomason Engineering College, Rurki, in the northwest provinces of India. Applications should be addressed to the Secretary, Indian Office, London.

A SELECT committee of the British House of Commons has been appointed to inquire into and report upon the administration and cost of the museums of the Science and Art Department. Parliament will consider appropriations for a frontage of South Kensington Museum and the use of the electric light in the Natural History Museum.

THE Lowell Observatory has not found the site in the vicinity of the City of Mexico as favorable as had been expected and will be moved back to Flagstaff, Arizona.

DR. MARSHALL WARD, professor of botany at Cambridge, reports that a collection of Pyrenean and Alpine plants, made by the late Mr. Charles Packe, M. A., Christ Church, Oxford, has been presented to the Herbarium, by his widow, Mrs. Charles Packe, Stretton-park, Leicestershire. The specimens, on about 3,700 sheets, are mounted and named, and were for the most part collected by Mr. Packe himself between 1858 and 1893.

PROFESSOR H. C. BUMPUS has arranged for the students of comparative anatomy of Brown University, according to the New York *Evening Post*, an excursion on Narragansett Bay during the spring recess. A steamer has been chartered for the purpose and seventy students are taking part in the work.

THE final sitting of the International Sanitary Conference at Venice took place on March 19th, when the protocol was signed. It will be sent for signature to those governments whose representatives had already left Venice. Turkey signed it with reserves. Besides the ambassadors and ministers of the Powers, the following-named technical delegates have signed the protocol as plenipotentiaries: Dr. Thorne, for England; Professors Brouardel and Proust, for France; Professor Emergen, for Belgium, and Dr. Ruisch, for Holland.

DR. E. H. WILSON, Chief of the Bureau of Bacteriology in the Brooklyn Health Department, secured, some time ago, bacilli of the Bubonic plague and has made experiments with them. He finds that sunlight and desiccation cannot be relied upon to limit the viability of this bacillus under commercial circumstances. The bacilli survived for forty-three days when desiccated. Dr. Wilson consequently holds that rags, mails, ballast and general merchandise coming from infected ports should be subjected at either the port of departure or the port of entry to a thorough system of disinfection.

STATISTICS of the French population for 1895 show a decrease of 17,000. There was a decrease in 1890, 1891 and 1892, but this was at the time attributed to the prevalence of influenza. The birthrate in France, which at the beginning of the century was 33 per thousand, has now decreased to 22.

A CORRESPONDENT of the London *Times*, in reviewing the consumption of intoxicating liquors in Great Britain and Ireland during the year 1896, shows that, as compared with 1895, there has been an increase, costing over six and a half million pounds, the total expenditure being £148,972,230. This is the largest amount ever spent in the United Kingdom for alcoholic liquors, though the annual expenditure per head for the years 1871–78 was greater. The cause of the present backsliding after a temporary improvement is not evident, for it is probable that the number of total abstainers is increasing.

ONE of the English anti-vivisection societies wrote to the Prince of Wales requesting that none of the money subscribed in honor of the Queen's Jubilee should be given to hospitals maintaining laboratories in which experiments are made on living animals. The Prince of Wales replied through his secretary that it would not be advisable for him to enter into any collateral consideration regarding the disposition of the fund. In his original appeal the Prince of Wales had emphasized hospitals as being not only institutions for the relief of suffering, but also places affording a means of medical education and the advancement of medical science.

THE President of the British Board of Trade stated, at the meeting of the Association of Chambers of Commerce on March 10th, that the bill introduced last session by the government legalizing the metric system of weights and measures would be brought forward, but that a compulsory measure could not be carried in the present state of public opinion. It was proposed before the Association, "That, whilst approving of the bill introduced into the House of Commons last session proposing to legalize the use of metric weights and measures, this Association is at the same time of opinion that the bill should be amended in the following respects: (1) That the decimal system as defined in the bill shall be a compulsory subject of instruction in all the elementary schools in the kingdom; (2) that the use of the decimal weights and measures so proposed shall be optional for only two years after the passing of the bill, and shall then be compulsory." This resolution was, however, not carried. A compulsory introduction of the metric system seems to have been regarded as desirable, by the Association, but not as feasible. It was stated by Sir Samuel Montagu, M. P., President of the Decimal Association, that the passing of a permissive bill would encourage the United States to take a further step in the matter and pass a compulsory bill. If that were done Great Britain would have to follow, as a matter of course.

PROFESSOR JASTROW'S letter to this JOURNAL (p. 26) entitled 'a test on diversity of opinion' was republished in the London *Academy*, but under a misleading title. A number of correspondents sent solutions to the *Academy*. But Professor Jastrow would prefer to have answers sent directly to him, as it is his wish not to secure answers to the problem, but data for the study of diversity of opinion, and for this purpose the answers should be independent.

PROFESSOR KARL PEARSON has collected his scientific essays dealing with problems of chance and variation, several of which are of special interest to students of anthropometry and evolution, which will shortly be published in two volumes by Edward Arnold.

THE Clarendon press will publish a series of five books on musical history, under the editorship of Mr. W. H. Hadow, fellow of Worcester College.

THE New York State Library has just issued its seventh annual comparative summary and index of State legislation, covering the laws passed in 1896. Each act is briefly described or summarized and classified under its proper subject-head, with a full alphabetic index to the entries. It is proposed that the eighth bulletin shall consolidate into a single series, with the legislation of 1897, the summaries for the preceding seven years. This material will be closely classified and so presented as to give a

clear view of the general progress of legislation for the eight years ending in 1897.

A SECOND edition of Professor Bailey's 'Survival of the Unlike' having been called for, he has prepared a new preface, in the course of which he thus summarizes his views on heredity and variation: "I conceive the organic creation to have started out with no definite tendencies so far as the corporeal forms of organisms are concerned, but these tendencies have all been developed—heredity amongst the rest—by the environmental necessities of later time; whilst variation or plasticity was a normal and necessary feature of the original form of life, this constitutional elasticity has been constantly bred out by the pressure of circumstances, and the subsequent variation has come to be more and more the result of definite environments. In some groups, in which the decline towards extinction has now well progressed, or when environments are very stable, organisms reproduce themselves with considerable rigidity, so that it may be said that like produces like. In some of the variable groups, which, presumably, have not yet reached the height of their development, it might with equal truth be said that unlike produces unlike. But, in any event, the normal or original fact is conceived to be that unlike produces unlike. At the present time it would be truer to say that similar produces similar." We are glad to learn that Professor Bailey is contemplating a work on the philosophy of the evolution of plants.

THE Cairo correspondent of the London *Times* writes that the second annual horticultural exhibition was opened by the Khedive on January 22d. This year an agricultural department was added, comprising exhibits of food, forage, textile and dyeing products from all parts of Egypt. A novelty was specimens of bagging and fine canvas made from the fibre of the sisal agave, the cultivation of which has lately been introduced by Mr. E. A. Floyer, who has established 30,000 plants in various places, and anticipates that after two years their produce will attain important dimensions. The plant requires very little care or irrigation, and can be grown in places unsuited for other crops. The fibre exhibited was decorticated in a hand machine invented by M. Faure, Messrs. J. Planta and Co., Swiss merchants, of Alexandria, who have established a scientific experimental cotton plantation near Zagazig, on which 60 different cultivations are being made, exhibited some of the results of their enterprise in an artistic kiosque, where every detail connected with the plant could be studied. The display of vegetables, chiefly by natives and the youths of the Agricultural College, contained some fine specimens, grown to a considerable extent from imported English seeds, for which a good demand has sprung up. The Finance Ministry's nursery garden at Ghezireh is an active agent in cultivating and distributing economic plants. Immediately after the exhibition it received applications for 5,000 young trees from native cultivators. The show of butter, vying with the best descriptions produced in Europe, was remarkable as representing an industry dating from only three or four years back.

UNIVERSITY AND EDUCATIONAL NEWS.

THE late Sir Thomas Elder has bequeathed £155,000 for public objects in Adelaide, including £65,000 for the University.

MR. W. H. CORBETT, the new United States Senator from Oregon, has given the Pacific University, Forest Grove, Ore., $10,000.

THE report that the University of Wisconsin had overdrawn its account on the State Fund is incorrect. We are informed on the best authority that the balance to the credit of the University is $40,000.

WELLESLEY COLLEGE will receive $3,000 for a scholarship through the will of the late Sarah S. Holbrook.

FUNDS are being collected for a Joseph Mosenthal fellowship of music in Columbia University, $6,000 having already been given.

PROFESSOR H. WILSON HARDING, who for 25 years has held the chair of physics and electrical engineering at Lehigh University, will be made professor emeritus at the end of the present year.

BRYN MAWR COLLEGE awards annually three traveling fellowships. One of these has just been awarded to Miss Margaret Hamilton in natural science and one to Miss E. N. Martin in mathematics.

MR. ARTHUR H. PIERCE, Kellogg fellow of Amherst College, has begun a course of lectures on psychology at the College. The Kellogg fellowship is the most valuable in the gift of any American university. The income of $30,000 is given to the holder for seven years, part of the time to be spent in study abroad, and part in residence at Amherst with certain duties as lecturer.

THE New York *Evening Post* reports that the museum of economic geology of New York University has recieved a full series of specimens illustrating the coal beds in the several anthracite basins. Series exhibiting the peculiarities of the ores and enclosing rocks have been sent by the officers of eleven important mines in Montana, Nevada, Utah, Colorado and Arizona, and similar series have been received from several of the more celebrated iron mines. The department of geology has been assigned for the present the south end of the new museum, which is approaching completion. It has a length of between eighty and ninety feet, and a width of over thirty-five feet, and will comprise three sections, namely, the museum section, the laboratory section and the classroom section. The space in the temporary building now occupied by geology will be given to the department of biology.

AN attempt is being made to secure funds for the endowment of a professorship in agriculture and forestry at the University of Cambridge. During the present year a short course of lectures on the practice and science of agriculture have been given by Professor Somerville, of the Durham College of Science.

A DESPATCH to the London *Times* from St. Petersburg says that more than a thousand students of the University and other institutions have been arrested at the very doors of the Cathedral of Our Lady of Kazan. They were endeavoring to attend prayers said for the soul of a girl student named Vitroff, who, it is alleged, set fire to her blanket and burned herself to death in her prison cell, to escape the insults and violence of a prison official. She had been imprisoned since December, on the charge of being a political agitator.

DR. CLASSEN, of the Polytechnic Institute at Aachen, has been appointed professor of chemistry in the University at Kiel; Dr. A. Palladin, professor of plant anatomy and physiology at the University of Warsaw, and Dr. de Vries, docent at the Polytechnic Institute at Delft, professor of geometry in the University of Utrecht. Dr. W. Beneke has qualified as docent in botany in the University of Strasburg.

DISCUSSION AND CORRESPONDENCE.

THE FORMER EXTENSION OF ICE IN GREENLAND.

SINCE the facts in the case will soon be published there might seem to be no especial need of continuing this discussion, but I do not feel that I should leave it while Professor Chamberlin is insisting that I have misinterpreted him. It is *not* a question whether he thought the Upper Nugsuak region had been glaciated, but upon what evidence he has drawn his sweeping conclusion that 'the ice fell short' of half the Greenland coast in a distance of a thousand miles. It would be of interest to know more exactly where the half is, but that is not the point. This conclusion is certainly based upon angular topography, mainly seen from a vessel.

My contention is that this class of evidence by itself is of *no value*, and in proof of this I point out that distinctly angular peaks have been glaciated and, moreover, that one of the most angular now rises in the midst of the Cornell glacier. I have not seen a thousand miles of the Greenland coast, but have seen nearly half that, including the island of Disco, the Waigat Strait and Umenak Fjord. Nowhere in all this distance did I see more rugged topography than that of the Upper Nugsuak peninsula region, *as viewed from the sea.* Professor Chamberlin thinks that the topography on this peninsula is the partly subdued, not the entirely unsubdued upon which he bases his generalization. It would require much more delicately made observations than any of our party was able to make to detect this difference.

The prediction is made by Professor Cham-

berlin that when pronounced upon by 'experts' in glacial topography, there will be seen to be a difference between the two types as illustrated by the photographs. If so, it should be a requisite that such an expert should have been to the top of some of the unsubdued peaks to prove that they have not been glaciated. The mere conclusion based upon a conception of what seems probable should not suffice. I know for my own part that until I got to the top of some of the high peaks on the Upper Nugsuak I could not believe they had been ice-covered; yet I found that the ice had not only covered them, but had extended at least twenty miles further. From my studies the conclusion was forced upon me that isolated peaks, as well as those rising well above the general level, may be glaciated for a long time and still remain very angular.

I am not engaged in an 'attempt' to place Professor Chamberlin in error, as he states, but intend to point out what I believe is an error of judgment. What glacial geology needs above all other things at present is a greater body of fact upon which to base our conclusions. We now have the fact that many parts of the Greenland coast are angular; we have the further fact that a region of angular topography has been glaciated. It is the *truth* that we wish to see discovered, whether this proves that all of Greenland has been glaciated or only a part; but until more facts are obtained I hold that Professor Chamberlin's conclusion that the ice did not extend into the heart of Baffin's Bay is based upon evidence of such a questionable nature that it ought not to be accepted. I, therefore, say again, let us get facts and trust more in them than in 'expert judgment.' When this is done glacial geology will have a better reputation.

R. S. TARR.

CORNELL UNIVERSITY.

So long as Professor Tarr continues to insist that a glaciated and a partially subdued topography cannot be distinguished by its contours, although his own observations show the discriminations of two observers, on separate trips, to have been essentially correct, and so long as he persists in calling a topography unqualifiedly angular which these observers have distinguished from the unqualifiedly angular, it seems idle to continue to discuss the subject. In pursuance of his urgency of the importance of fact and truth and better methods in glaciology there is but one defense which he can properly make, and that is to publish in SCIENCE, whose readers he seeks to influence, the photographs which accompany his Washington paper. Glacialists will then be able to judge for themselves whether glaciation is or is not indicated by the topography.

T. C. CHAMBERLIN.

HISTORY OF ELEMENTARY MATHEMATICS.

IN Professor Blake's appreciative review of my 'History of Elementary Mathematics' there are two or three statements which appear to me open to objection. It must be admitted that, if the logarithm of x be defined by the relation $x=b^{\log x}$, b being constant, then, strictly speaking, Napier's numbers are not logarithms. It is the knowledge of this fact which led me to write in my history (p. 160): "In determining, therefore, what the base of Napier's system would have been, we must divide each term in the geometric and arithmetic series by 10^7." In the light of this remark, my statement that the base 'demanded by his [Napier's] reasoning is the reciprocal of that of the natural system' seems correct. The real question raised by Professor Blake's criticism is this: In considering the matter of a base, what is the best method of describing the nature of Napier's logarithms to a modern student? My claim is that the method of dividing each of Napier's numbers and logarithms by 10^7 and then finding the *fixed* base—a method which I followed in imitation of W. R. MacDonald, M. Marie and others—is more readily grasped by the elementary student than the one involving the difficult notion of a *variable* base, suggested by Hagen and Blake.

The sentence '$\sqrt{2}$ cannot be exactly represented by any number whatever' is correct from the Greek point of view, for on page 29 I say that 'by the Greeks irrationals were not classified as numbers.'

I am unable to find anything on page 74 which would 'lead one to suppose that rigor demands our ability to construct* * *every in-

scribed polygon we may wish to use.' The example in question refers to a problem, to inscribe in a circle a regular polygon of any given number of sides.

FLORIAN CAJORI.
COLORADO COLLEGE,
COLORADO SPRINGS, March 2, '97.

SCIENTIFIC LITERATURE.

Microscopic Researches on the Formative Property of Glycogen. Part I., Physiological. By CHARLES CREIGHTON, M.D., Formerly Demonstrator of Anatomy at Cambridge. London, Adam and Charles Black. 1896. With five Colored Plates. Pp. 152.

Dr. Creighton's work, as stated in the preface to the present volume, has been directed especially to the problem of glycogen in the formative processes of disease, but it was found necessary to turn aside at numerous points in search of a physiological basis or paradigm, and as a result we have the present volume, dealing mainly with the bearing of glycogen on normal growth. Emphasis is laid upon the fact that the glycogen of animal tissues is not destined solely for conversion into sugar, but that in embryonic formations, as well as in pathological new growths, glycogen presents itself in its tissue-making, not its sugar-yielding character. Dr. Creighton's microscopic studies lead him toward the somewhat broad generalization "that the formative property of glycogen is analogous to or parallel with that of hæmoglobin; * * * that glycogen plays the part of a carrier to the tissues; that it contributes somewhat to the building up without losing its own molecular identity; that it is present at the formation of tissues and employed therein without becoming part of them, and that it acts thus, in some cases as the precursor or deputy of hæmoglobin, and until such time as the vascularity of the part is sufficiently advanced; in other cases as the substitute of hæmoglobin from first to last—in those tissues which are built up in whole or in part without direct access of blood."

The observations which lead to this somewhat startling view are made upon tissues, organs or whole embryos, usually fixed in potassium bichromate and hardened in absolute alcohol, the presence or absence of glycogen being determined in the sections of tissue by the usual method of treatment with a weak solution of iodine in potassium iodide. Attention is called to the fact that methyl-violet, contrary to the view frequently held, also gives a distinctive reaction with glycogen, the dye picking out the spots of glycogen from all other parts of the section as distinctively as iodine itself. This method, however, possesses no practical advantages over the iodine method.

Dr. Creighton has studied especially the relation of glycogen to the growth of the bronchial tree and of the choroid plexuses; its relation to the formation of the renal tubules and the development of the intestinal mucous membranes; its distribution in fœtal hoof, nail and hair, and in the developing and functional striated muscular fibre; its relation to the enamelling and cementing of teeth; its presence in cartilage and in the developmental and other immature secretions of the mammary glands, etc. As noted by many previous observers, glycogen is found to be especially prominent in these young embryonic tissues, especially at the centers or points of rapid growth, and at a time in fœtal life when the vascularity of the part is limited or not even established. The point, however, upon which most stress is laid is that glycogen is the dynamic principle in the developing tissue; in epithelial cells, for example, as in the formation of the renal tubules, the glycogen being the precursor of hæmoglobin as a formative agent. Thus, in the tubular formation within the kidney the advancing and differentiating epithelium is supposed to depend mainly, if not solely, upon resources contained within itself, *i. e.*, the glycogen, pending the complete establishment of vascularity, when the glycogen disappears. Similarly, in the muscular tissue of active or mature life, glycogen, like the hæmoglobin, is looked upon as a reserve store for emergencies. Although not essential to the activity of the muscle, it may, perhaps, says Creighton, take the place of the circulating blood in one way as the store or reserve of hæmoglobin does in another, or possibly there may be muscles in which the reserve is chiefly hæmoglobin, and others in which the reserve is mainly glycogen.

The physiologist has no hesitancy whatever

in accepting the view that glycogen is a reserve material of primary importance in the growth and development of new tissues, but it may well be considered whether the theory formulated by Barfurth, that the glycogen so abundant in new growths is a bye-product resulting from the cleavage of complex proteids, ready to be again utilized or stored up as reserve material as occasion demands, is not more consistent with present knowledge than the assumption that glycogen contributes somewhat to the building up of the tissues 'without losing its own molecular identity,' or that it is employed in the growth and development of the tissues without becoming part of them. The very nature of glycogen—certainly, as we ordinarily use the term—is opposed to the stability assumed in the preceding quotation. Far more plausible is the assumption that glycogen is a prominent product of metabolic activity, and as such may be widely formed in all developing tissues, while in the absence of circulating blood, which precludes its immediate removal, it may accumulate for a time in the growing tissues, doubtless being used again in the construction of fresh protoplasm. Indeed, it is so readily decomposable that it naturally constitutes a valuable pabulum for the nutrition or growth and development of fresh tissue. In this sense we can readily conceive of its importance, both as a measure of some forms of metabolic activity and as an aid to new growth, but wholly as a chemical substance which, like other kindred carbohydrates, can be utilized by the living cells which are of necessity the active agents in all growth. But Dr. Creighton, if we understand him aright, attributes to the glycogen of embryonic tissues a kind of intangible power which makes it the forerunner and pioneer of new growths, without loss of its own molecular identity and without becoming an integral part of the tissues.

Thus, in considering the glycogen so noticeable in primordial cartilage it is stated that "one function of the glycogen of cartilage may be guessed to be the separating out of calcareous salts from the protoplasm in such wise that they become visible in the form of granules or vesicular drops. Of course, by far the most of the calcareous matter of bones must come to them direct from the blood; but there is a period of development, the period of transition from cartilaginous moulds, at which lime salts are deposited independently of the blood and in some unknown manner by the agency of glycogen. Assuming that to be a real office of glycogen within the cells of cartilage, it need not exhaust its functions. The diffusion of glycogen through the cartilage-protoplast appears to impart to it a certain mobility or dynamic property, whereby cavities are hollowed out in the matrix and the partitions absorbed in aid of the formation of the central space which the blood-vessels enter and possess. Even when all trace of cartilaginous structure is lost, it appears probable that some of its protoplasm, still occupied by glycogen, is utilized in the form of ostoclasts for the further modelling of the medullary canal or the cancellous tissue. These various uses of glycogen, or purposes to which it may be put, are consistent with the view of it as an intra-cellular or parenchymatous medium, doing duty for a time, or in occasional circumstances, in place of the great internal medium, namely, the blood itself." This somewhat lengthy quotation is a good illustration of the character of the activity or dynamic power which Creighton constantly attributes to the glycogen present in embryonic tissues. To the unbiased reader, however, it would seem that such conclusions are hardly warranted, although it is possible that, in the pathological part to follow the present volume, additional facts will be presented which may tend to strengthen the author's peculiar views. Glycogen may well be considered in the above tissue as a pabulum, which, like the blood itself, furnishes material necessary for the growth and activity of the developing cells, but we fail to see why it should be necessary to attribute to the glycogen a special formative power so radically different from that heretofore attributed to carbohydrate matter in general; a formative power which raises the intra-cellular glycogen to the plane of living protoplasm itself. Its presence in the protoplasm may give to the latter increased activity, may indeed endow it with peculiar and exceptional power for the time being, but it seems far more consistent to consider that the true formative power resides

in the cell-cytoplasm and karyoplasm rather than in the glycogen as a substance by itself. It seems to the writer that the physiologist must demand very conclusive evidence before he can accept the view that "glycogen plays the part of a carrier to the tissues; that it contributes somewhat to the building up without losing its own molecular identity; that it is present at the formation of tissues and employed therein without becoming part of them."

In conclusion, it must be stated that the volume contains a record of most careful observations and that it is replete with interesting and important facts bearing upon the distribution of glycogen in embryonic tissues. Further, due weight must be given to Dr. Creighton's conclusions, although, as already stated, it appears to the writer that physiologists will have some difficulty in accepting them in their entirety. R. H. CHITTENDEN.

YALE UNIVERSITY.

Analytic keys to the genera and species of North American Mosses. By C. R. BARNES. Revised and extended by F. D. HEALD, with the cooperation of the author. Bull. Univ. Wis. Sci. ser. I., 5, pp. 157–368, 1897.

This bulletin is the 3d edition of analytical keys of mosses published by the author. The first edition, published in 1886, included only the genera recognized in Lesquereux and James' Manual. To this was added in 1890 keys to the species, including descriptions of those published since the issue of the Manual. During the past decade there has been great activity in the study of North American mosses, which is shown in the description of 603 species and varieties since the publication of the Manual and up to January 1, 1896. The present bulletin includes besides the analytical keys descriptive of these 603 species and varieties as an appendix.

As a basis for the nomenclature used in the work the author has followed Renauld and Cardot's *Musci Americæ Septentrionalis*, preferring to do this rather than make new combinations which would necessitate the citation of the 'Analytical Keys' in future taxonomic work. The former keys have been very useful to bryologists in this country, and students of the mosses have been further placed in debt to the author by this comprehensive revision of the work. GEO. F. ATKINSON.

CORNELL UNIVERSITY.

SCIENTIFIC JOURNALS.

JOURNAL OF GEOLOGY, FEBRUARY–MARCH, 1897.

Professor Geikie's Classification of the North European Glacial Deposits: By K. KEILHACK. The classification proposed in this *Journal* by Professor James Geikie, in which six glacial epochs separated by five interglacial epochs are recognized, is criticised. In its place is offered an unofficial announcement of the results of the detailed mapping carried on by the Royal Prussian Geological Survey.

The Average Specific Gravity of Meteorites: By O. C. FARRINGTON. Account is taken of both the weight and the specific gravity of 142 specimens which give an average of 3.69.

Drift Phenomena in the Vicinity of Devil's Lake and Baraboo, Wisconsin: By R. D. SALISBURY and W. W. ATWOOD. The region studied is on the eastern edge of the Driftless Area where the Wisconsin ice pushed out over certain high quartzite ridges. The rough topography (900–1600 A. D.) lead to certain exceptional phenomena in connection with the drift border. The ice mounted the high ridges but halted on the summits in a most peculiar manner. The edge of the ice is marked by a moraine of the character known as 'Endmoräne' by the Germans. Where it crossed the 'Devil's Nose' the slope of the upper surface of the edge of the ice was measured and found to be about 320 feet per mile. This measurement has the exceptional interest of being the first recorded measurement at the extreme margin of the ice. Skillett creek was diverted by the filling up of its lower course by the overwash; the Baraboo was dammed and a temporary lake was formed, and on the east quartzite bluff a smaller lake was formed which finally became extinct by the complete filling up of its basin.

Comparison of the Carboniferous and Permian Formation of Nebraska and Kansas, II.: By CHARLES S. PROSSER. A continuation of the author's paper in the preceding number of the *Journal*. The Nebraska City section is quite

fully discussed and the exposures of Cass county are treated in detail.

The Geology of the San Francisco Peninsula: By ANDREW C. LAWSON. A retort to the criticism appearing in the preceding number of the *Journal*, of the author's paper, by H. W. Fairbanks.

Note on the Geology of Southwestern New England: By WM. H. HOBBS. The structure of the apparently anticlinal ridges of Berkshire schist was studied in the ridge of schist immediately to the south of the east Twin Lake in the township of Salisbury and in the mass of Tom Ball near Housatonic village. The observations obtained have been sufficiently numerous and reliable to show that the folds are either overturned anticlines with easterly dipping axial planes or nearly recumbent *fanned* synclines with the axial planes inclined to the eastward. The ridge south of Twin Lakes was followed southward into Watewanchu Mountain, where the limestone can be seen to pass under the schist on the end of the fold. This latter locality is, therefore, a crucial one and shows that the apparent anticlines of schist are nearly recumbent synclinal folds with the necks compressed so as to produce a fan structure.

Studies for Students. Deformation of Rocks V. Supplementary Notes: By C. R. VAN HISE. Notes supplementary to the author's recent papers with reference especially to the following topics are given: Separation of the outer crust of the earth into zones; Plastic flow produces folding; Complex folds; Monoclinal anticlines and synclines; Position of cleavage in anticlines and synclines; Relations of cleavage produced by shearing and shortening; Relations of cleavage and fissility to faults; Relations of joints to bedding; and Relations of joints to folds.

H. F. B.

AMERICAN CHEMICAL JOURNAL, MARCH.

On the Decomposition of Diazo Compounds: By JOHN J. GRIFFIN. The author has studied the reaction of ethyl and methyl alcohols with paradiazometatoluenesulphonic acid in the presence of various substances, as sodium methylate, sodium carbonate, sodium hydroxide, zinc dust, calcium carbonate, sodium ethylate and ammonia. When diazo compounds are decomposed by alcohols, one of the products formed contains either hydrogen or an alkoxy group in place of the diazo group. The influence of temperature and pressure on this reaction has been studied with a number of diazo compounds, and the present research was a continuation in this line. When the substance under investigation was decomposed in alcohol in the presence of an excess of some alkali and zinc dust, only the hydrogen reaction took place; that is, the diazo group was in all cases replaced by hydrogen, the nature of the alcohol in these cases having little, if any, influence on the reaction. When the decomposition took place in alcohol saturated with ammonia, the ammonium salt of paratoluidinemetasulphonic acid was formed. The product in each case was converted into the amide and separated by crystallization. The properties of this amide were studied, and some of it was oxidized to metasulphaminebenzoic acid, and its properties and those of its salts were also studied. The only exception noted was with calcium carbonate, which had no influence on the diazo decomposition.

The fact that pure metatoluenesulphonamide could be made in any desired quantity by these reactions suggested transforming it into the acid, to settle the contradictory statements which have been made about its properties. The pure acid and a number of its salts were prepared, and the results indicated that the substances hitherto obtained had not been pure.

On the Colored Compounds Obtained from Sodic Ethylate and Certain Aromatic Nitro Compounds: By C. LORING JACKSON and M. H. ITTNER. A number of investigators have observed and studied the strikingly colored substances formed by the action of alkaline solutions on certain aromatic nitro compounds. Some of these colored substances have been isolated and analyzed and some light has been thrown on the conditions governing their formation. The authors have prepared and studied the action of about fifteen complex nitro compounds. The duration of the color varied from a few seconds to hours, related substances behaving in general alike. The explanation advanced by Victor Meyer, that these compounds are salts formed

by the replacement of an atom of hydrogen of the benzol ring by the metal, is not applicable here, as he considered the hydrogen replaced to be the one between the the nitro groups. In the compounds here studied this position is occupied by other groups, but it is perhaps the hydrogen between the nitro and carboxyl groups which is replaced. The evidence, however, is not conclusive, as there are facts which support this theory and others which are against it. One of these colored compounds was isolated and studied and some derivatives prepared.

On the Action of Chlorcarbonic Ethyl Ester on Formanilide: By H. L. WHEELER and H. F. METCALF. The authors have given in a recent number of this *Journal* the method of preparation of formylphenylurethane. According to some authors this breaks up, giving an amidine and other products. The authors show that the oil obtained by Freer and Sherman in this reaction was not, as they stated, ethylisoformanilide, but a mixture of several compounds. They also succeeded in isolating a number of other final reaction products. The structure of formanilide is represented in two ways, either as an anilide or as an imido compound, phenylimidoformic acid. The structure cannot be determined by the final reaction products, as the formation of all the compounds can be readily explained by either structure. According to the authors the weight of evidence from recent work favors the imido-acid structure.

Notes of Student Work from the Laboratory of Analytical Chemistry, University of Virginia: By F. P. DUNNINGTON. Analyses are given of a variety of Ilmenite; of 'Mineral Tallow' from Vermont; of Marble from Texas, Md.; of Alum Water from Lee county, Va., and of Infusorial Earth. A number of determinations were also made of the power of certain calcium and magnesium salts to absorb and retain water. No regularity in the amount lost in certain time could be detected, different salts requiring different times to be dehydrated. The formation of definite hydrates by absorption of water could not be established by a study of the amount taken up.

The Proteose of Wheat: By T. B. OSBORNE. The author calls attention to certain wrong assumptions which Mr. G. E. Teller had made in a recent article in this *Journal*, and also to a fact he had overlooked in quoting the author's work. The following books are reviewed: An Introductory Course of Quantitative Chemical Analysis, with Explanatory Notes and Stoichiometrical Problems, H. P. Talbot; A Simple Method of Water Analysis, Especially Designed for the Use of Medical Officers of Health, J. C. Thresh; The Gases of the Atmosphere, The History of their Discovery, W. Ramsay; A Manual of Quantitative Chemical Analysis for the Use of Students, F. A. Cairns. An obituary notice of Eugene Baumann is also contained in this number.

J. ELLIOTT GILPIN.

THE ASTROPHYSICAL JOURNAL, NOVEMBER, 1896.

A Further Study of the effect of Pressure on the Wave-lengths of the Lines in the Arc Spectra of Certain Elements: By W. J. HUMPHREYS. In their previous work along this line* Messrs. Mohler and Humphreys investigated the spectra of twenty-three elements. The present paper covers experiments upon some twenty-three more. With some exceptions, the results of the previous investigations were verified. In particular, the law that the shift is proportional to the pressure into the wave-length of the line considered was found to hold. In this connection it was found necessary to divide the strontium and barium lines into two groups, as had been done with calcium. The relation of the shift to the position of the element in its Mendelejeff group is also discussed.

Prominences Observed August 8, 1896: By J. FÉNYI. Observations of the prominences are given as being of possible interest in connection with the solar eclipse of the above date.

Notes on a Method of Determining the Value of the Light Ratio: By ALEXANDER W. ROBERTS. A discussion of a method of determining the light ratio for a system of magnitudes. That is if the magnitudes of a number of stars are given, with an unknown light ratio between the magnitudes, a method is suggested by which from an estimation of the magnitude of two superimposed star discs the ratio may be determined. A discussion of algol variables follows.

* Ap. J. February, 1896.

The Modern Spectroscope XX. On a New Fluid Prism Without Solid Walls and its Use in an Objective Spectroscope: By F. L. O. WADSWORTH. The writer suggests that a plane mirror slanting downward at the proper angle be introduced into the dispersing fluid, and that the level surface be made to form the face of the prism. The arrangement is similar to that in the Lettrow form of spectroscope.

Preliminary Table of Solar Spectrum Wave-lengths: By HENRY A. ROWLAND. One of the regular series of tables.

Researches on the Arc Spectra of the Metals III. Cobalt and Nickel I. One of the regular series of papers by B. HASSELBERG. The measurements of the wave-length are discussed and probable impurity lines eliminated.

Minor Contributions and Notes—Recent Astrophysical Publications.

DECEMBER, 1896.

Oxygen in the Sun: By C. RUNGE and F. PASCHEN. In the oxgen vacuum tube there exists a triplet: λ 7772.26, 74.30, 75.97, which is also found in the solar spectum. As the solar spectrum is comparatively weak in lines in this region (which is on the outside edge of the red) the chance of coincidence with lines of foreign origin is less than elsewhere. It is therefore suggested by the writers that observations upon these lines be made, to determine their solar or telluric origin, whichever it may be. If the origin be solar the writers believe the existence of oxygen in the sun will be proved.*

The Algol Variable + 17°4367; *W. Delphini:* By EDWARD C. PICKERING. An ephemeris and light curve for the star.

The Determination of the Various Quantities of Aqueous Vapor in the Atmosphere by Means of the Absorption Lines of the Spectrum: By L. E. JEWELL. An investigation of the relative intensities of the water vapor lines on the red side of the D lines, in connection with meteorological readings.

* Recent observations by Mr. L. E. Jewell at Johns Hopkins University show that the triplet varies in intensity upon different days in the same manner in which the water vapor lines do, thereby indicating that it is due to that substance in the earth's atmosphere and not to oxygen either here or in the sun.

Researches on the Arc Spectra of the Metals III. Cobalt and Nickel II: By B. HASSELBERG. A continuation of the details of comparison by which impurity lines are eliminated from the spectra of these elements.

Minor Contributions and Notes. Including H. C. O. circulars No. 12, 13 and 14. No. 13 contains a description of the spectrum of Puppis. This spectrum in addition to dark hydrogen lines and the line K contains a series of dark lines that are satisfied by Balmer's formula less a constant term.*

JANUARY, 1897.

On the Spectroscopic Binary α[1] Geminorum: By A. BELOPOLSKY. Containing an account of the detection of the binary character of the principal component of castor. A general discussion of the elements is also included.

On an Automatic Arrangement for Giving Breadth to Stellar Spectra on a Photographic Plate: By WILLIAM HUGGINS. Dr. Huggins suggests in this article that an eccentric gear wheel be put in the clock mechanism so as to produce an oscillation of the telescope during exposure. This will cause the stellar image to move back and forth over the desired length of slit. The advantage claimed for this method, over the one ordinarily in use (that of changing the rate of the clock, which was also due to the writer), is the saving of time ordinarily wasted in the resetting, and in general convenience.

On the Application of Interference Methods to the Determination of the Effective Wave-length of Starlight: By GEO. C. COMSTOCK. An investigation taken up in connection with the effect of refraction upon the apparent places of stars. The author claims that for physiological reasons the effective wave-length can not be determined by matching the apparent color of the stars with the spectrum. The following device was adopted. The objective of the equatorial was covered by a diaphragm having two parallel slits cut out of it. When the telescope was pointed at a star there resulted the usual dif-

* More recent investigations by Professor Pickering, and Professor Kayser, indicate that this second series is also due to hydrogen under physical conditions different from those under which it has been previously observed.

fraction pattern, consisting of a central band with a series of fainter ones ranged symmetrically on each side. The most distant of these resembled faint stars, and were of course due to the more intense part of the stars' spectrum. The distance of one of these bands from that symmetrically situated on the other side gave the data for the determination of the wavelength. The measurements were made directly with a micrometer.

Remarks on the Articles of Mr. E. J. Wilczynski: By PAUL HARGER. Being rather a spirited attack upon the validity of some of Mr. Wilczynski's assumptions in connection with his work on Solar Rotation.

Researches on the Arc Spectra of the Metals III. Cobalt and Nickel III: By B. HASSELBERG. One of the regular series of papers dealing with the measurement of lines and the elimination of impurities.

Preliminary Table of Solar Spectrum Wavelengths: By HENRY A. ROWLAND. Minor Contributions and Notes. Reviews of Recent Astrophysical Literature. Bibliography of Recent Astrophysical Literature.

SOCIETIES AND ACADEMIES.

TORREY BOTANICAL CLUB.

AT the regular meeting of February 9th, about 200 persons present, the scientific program consisted of a lecture by Mr. Henry A. Siebrecht, entitled 'Orchids; Their Habitat, Manner of Collecting and Cultivation,' handsomely illustrated with lantern slides by Mr. Cornelius Van Brunt, colored by Mrs. Van Brunt.

Mr. Siebrecht in his paper referred to the hardships undergone by the orchid collector, and paid a tribute to the energy displayed by three friends of the speaker, Carmiole, an Italian, who had come to New York when the speaker was a boy; Föstermann, who died about two years ago, the victim, like most collectors, of disease contracted in that enterprise; and Thieme, who had made three trips for Mr. Siebrecht, and who went last to Brazil in search of the *Cattleya autumnalis*, but was never heard from.

Mr. Siebrecht referred also to three trips of his own in quest of orchids, to the West Indies, Venezuela, Brazil and Central America. He then exhibited the lantern views, which were of remarkable beauty and evoked frequent applause. They included numerous representatives of the chief tropical genera cultivated, also with views of interiors showing the Cattleya house in full blossom, etc. Slides showing numerous species native to the Eastern United States followed.

Mr. Siebrecht then described the culture of orchids and classed their diseases, as chiefly because too wet, when the 'spot' closes the stomata, or too dry, when they collect insects. He referred to their insect enemies at home, the 'Jack-Spaniard,' which eats the marrow from the bulb, and Cattleya-fly, now introduced into English houses. He mentioned the ravages of *Cladosporium* and the great difficulty with which orchids of the genus *Phalænopsis* are preserved from fungal diseases.

The subject was further discussed by the President, Dr. Britton, Mr. Samuel Henshaw and Mr. Livingston, the latter referring to his recent experience as an orchid collector. A slide was exhibited, made from a photograph taken by Mr. Livingston, showing his orchids packed upon oxen and so carried down from the mountains to Magdalena.

Mr. Henshaw spoke of his visit to Mr. Siebrecht's nursery in Trinidad, and of the growth made there by Crotons, as much in one year as here in four or five. In those gardens they divide their plants by rows and edges of Crotons, which are sheared off as we would trim a privet-hedge. Mr. Henshaw also paid a deserved tribute to Mrs. Van Brunt for the wonderful success of her coloring of the orchid slides.

EDWARD S. BURGESS,
Secretary.

SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

AT the meeting on February 22, 1897, Professor F. H. King, in a paper 'The Movements of Ground Waters,' referred first to a world-wide zone, probably extending as deeply below the surface of the earth as rock fissures exist, and which is interpenetrated with water incessantly in motion. These movements were classified as

gravitational, thermal and capillary, due respectively to fluid pressure, osmotic pressure and surface tension. Charts were presented constructed from automatic, continuous records, showing that the ground water is constantly in a state of oscillation which may extend over a long period, may be seasonal, or may correspond with the high and low barometric waves associated with the movements of storms. The records presented show that the surface of the ground water in a well is much more responsive to atmospheric changes of temperature than the barometer itself, and during stormy weather the movements of the water surface are so complex and so short in period that a rapidly moving chronograph is required to separate them. Data from different wells and springs strongly suggest the existence of a lunar ground-water tidal disturbance. The variations in the rate of discharge of water from springs under barometric changes is very great, and the surface of Lake Mendota has been shown, even in winter when covered with ice, to be subject to extremely complex oscillation, some of which appear to be barometric. Professor C. R. Barnes, speaking on 'An Evolutionary Failure,' first discussed the meaning of the title, holding it applicable to those groups of organisms which do not give rise to higher forms. The evolutionary history of the mosses was briefly traced, showing that their ancestors diverged along two lines, one of which culminated in the mosses and the other in the seed plants. The cause of failure in the first case seems to have been due to the retention from lower stages of the two most important functions, nutrition and sexual reproduction, by the gametophyte; while success was attained in the other line by specializing the sporophyte for nutritive work.

W. S. Marshall,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis on March 15, 1897, President Gray in the chair, present also thirty-five members and guests, a portrait of Dr. Enno Sander, who for the past thirty-five years has served uninterruptedly as its Treasurer, was presented to the Academy. Dr. Hambach spoke entertainingly and instructively on what a geologist may find of interest about St. Louis, exhibiting specimens of the principal fossils and minerals characteristic of the local deposits, and indicating the best localities for the collection of certain specimens. One person was admitted to active membership.

William Trelease,
Secretary.

SCIENCE CLUB OF NORTHWESTERN UNIVERSITY.

At a meeting of the Club held March 5th, Professor William Locy read a paper on the 'Primitive Sense-Organs of Vertebrates and their Relations to the Higher Ones,' of which the following is a synopsis:

The sense-organs differ from one another mainly in degree of differentiation and specialization. They may be regarded as forming a series at the lower end of which are the simplest sensory papillæ, and at the upper end the highest developed sense-organs. From the combined results of investigations on both invertebrates and vertebrates it seems probable that the higher sense-organs have been derived from those of a lower order, and that they have all been differentiated from a common sensory basis, and, therefore, are related in a direct way.

In vertebrates the sense-organs of the lateral-line system are the most generalized, and it seems probable that from these most of the others have been derived. Especial attention was directed to the earliest rudiments of the vertebrate eye, and the bearing of the facts on the phylogenetic history of the eye, was discussed.

Thomas F. Holgate,
Secretary.

NEW BOOKS.

A Treatise on Rocks, Rock-weathering and Soils. G. P. Merrill. London and New York, The Macmillan Company. 1897. Pp. xx+411. $4.00.

An Outline of Psychology. Edward Bradford Titchener. New York, The Macmillan Company. 1897. Second Edition. Pp. xiv+352. $1.50.

The Aurora Borealis. Alfred Angot. New York, D. Appleton & Company. 1897. Pp. xii+264.